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American Journal of Diseases of Children

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BACTERIOPHAGE AND SKIN TESTS IN DIARRHEA OF UNESTABLISHED ETIOLOGY IN CHILDREN*

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The importance of diarrheal diseases in children as an outstanding cause of death is well recognized. Prior to the present widespread pasteurization of milk, more than 50 per cent of the infant mortality during the summer months was due to diarrheal diseases; even since the general improvement in the milk supply, brought about especially by pasteurization, these diseases constitute a large proportion of the causes of deaths in children during the hot season.

The term "diarrhea" is used to include all conditions attended by frequent loose stools. Types of diarrhea may be classified under two heads: those of known etiology and those of unestablished etiology. In the first group are included (*a*) bacillary dysentery [1] (*b*) amebic dysentery [2] and (*c*) paratyphoid fever; [3] in the second group are placed all other types of conditions characterized by loose bowel movements. There are more or less well recognized clinical classifications; for instance, "alimentary diarrhea" and "parenteral diarrhea." It is not known, however, in what manner parenteral infections or improper feeding brings about diarrhea; nor is the interrelation between these factors well established. For the purpose of investigation, diarrhea is therefore divided into two types on the basis of the character of the stools: (*a*) a type in which the stools are frequent, softer than normal and sometimes contain bile but not blood or pus, and (*b*) a type in which the stools not

* Received for publication, April 25, 1927.

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1. Davison, W. C.: Bacillary Dysentery in Children, Bull. Johns Hopkins Hosp. **31**:225, 1920. Duval, C. W., and Bassett, V. H.: The Etiology of the Summer Diarrheas of Infants: A Preliminary Report, Am. Med. **4**:417, 1902. Flexner, S., and Holt, L. E.: Bacteriological and Clinical Studies of the Diarrheal Diseases of Infancy with Reference to the Bacillus Dysenteriae, Studies of the Rockefeller Institute of Medical Research, New York, 1904.

2. Amberg, S.: Contribution to the Study of Amoebic Dysentery in Children, Bull. Johns Hopkins Hosp. **12**:355, 1901.

3. Schmidt, W.: Ueber Paratyphus im frühen Kindesalter, Ztschr. f. Kinderh. **39**:681, 1925. Gildemeister, E., and Baerthlein, K.: Bakteriologische Untersuchungen bei darmkranken Säuglingen, Deutsche med. Wchnschr. **39**:982, 1913.

only are more frequent, more fluid, and bile-stained, but also contain pus, blood and mucus. The latter three signs are evidence of an inflammatory lesion in the intestines. The latter type of diarrhea is variously termed "infectious diarrhea," "follicular enteritis," "infant diarrhea," "summer diarrhea" or "cholera infantum"; it is usually associated with improper feeding and hot weather, and frequently with demonstrable parenteral infection.

Numerous theories have been advanced to explain these types of diarrhea. There are two general theories: the first ascribes the diarrhea to the activity of micro-organisms; the second proposes a functional derangement as the underlying cause of the condition. There are four distinct variations in the theory that a micro-organism is the etiologic factor in the diarrhea:

1. The infection of the intestinal tract by a single type of organism has been thought to play a rôle analogous to that of *Bacillus dysenteriae* in bacillary dysentery. The condition has been ascribed to *B. coli* of increased virulence,[4] *B. proteus-vulgaris,*[5] *B. morgani* I (Morgan, H. de R., and Ledingham, J. C. G.: The Bacteriology of Summer Diarrhea, *Proc. Roy Soc. Med.* **2**: 133, 1908-1909. Logan, W. R.: The Intestinal Flora of Infants and Young Children, *J. Path. & Bact.* **18**: 527, 1913-1914), *B. pyocyaneus,*[6] *Streptococcus fecalis,*[7] *B. fecalis-alcaligenes*[8] and *B. welchii.*[9] Spirilla in increased numbers in diarrheal stools have been proposed as the causal agent by Trias,[10] and Cookson and Thorp[11] report an epidemic of diarrhea associated with the occurrence of parasitic fungi in the stools. The literature on this subject is voluminous, and no attempt will be made to discuss it here. Critical reviews and good bibliographies on the subject have been published by

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4. Escherich, T.: Die Bedeutung der Bakterien in der Aetiologie der Magendarmerkrankungen der Säuglinge, Deutsche med. Wchnschr. **24**:633, 1898.

5. Booker, W. D.: A Bacteriological and Anatomical Study of the Summer Diarrhea of Infants, Johns Hopkins Hosp. Rep. **6**:159, 1897. Tsiklinsky, M.: Contribution a l'etiologie des diarrheas des nourissons, Ann. de l'Inst. Pasteur. **31**:517, 1917.

6. Calmette, A.: Note sur la presence du bacille pyocyanique dans le sang et l'intestin de dysenteriques en Cochin chine, Arch. de méd. navale. **60**:207, 1892.

7. Blackader, A. D.: Epidemic of Hemorrhagic Diarrhea due to Streptococcus Mucosus, J. A. M. A. **75**:128 (July 10) 1920; Proc. Am. Ped. Soc. June, 1920. Holst, A.: Baumgartens Jahresbericht. **52**:545, 1896.

8. Kendall, A. I.: The Relation of Bacteria to the Etiology of Summer Diarrhea in Young Children, Boston M. & S. J. **172**:851, 1915.

9. Kendall, A. I., and Smith, R. M.: Diarrhea in Infants Associated with the Gas Bacillus in the Stools, Boston M. & S. J. **164**:306, 1911

10. Trias, A.: Ueber Durchfälle mit Spirillenbefund im Säuglingsalter, Monatschr. f. Kinderh. **32**:491, 1926.

11. Cookson, H. A., and Thorp, E.: An Outbreak of Infantile Diarrhea Associated with a Parasitic Fungus, Lancet. **2**:330, 1926.

Sisson [12] and by Davison.[13] Each of the theories is based almost entirely on finding increased numbers of the particular organism concerned in the diarrheal stools, and, in the case of each of the supposed causes, the same organisms are found frequently and sometimes plentifully in stools of normal children. In the case of some of the organisms implicated, agglutinins have been demonstrated irregularly in patients with diarrhea, but similar agglutinins have also been demonstrated in normal children.

2. The second variation in the theory of a micro-organism as the etiologic factor is based on the suggestion of some investigators that various combinations of fecal organisms may bring about intestinal disorders, in this instance, diarrhea.[14] They contend that a proteolytic flora may bring about one form, and a fermentative flora another form of diarrhea. There is some clinical evidence in favor of this contention, but in the main, it is not well established.

3. The actual site of infection is suggested by those who maintain that the diarrhea is due to invasion of the duodenum by organisms from a lower part of the intestine. It has been shown [15] that the duodenum, which is relatively sterile in normal children, is definitely infected with the same flora that is present lower in the intestine in children with diarrhea. For a time it was thought that the acidity of the gastric juice (and consequently its bactericidal action in the duodenum) was reduced in children with diarrhea,[16] but a subsequent investigation by Davison [17] did not substantiate this theory. The fact remains, however, that the normally sterile duodenum is infected with a fecal flora in many cases of diarrhea.[18]

4. Parenteral infections are frequently followed by diarrhea, and this condition is termed clinically "parenteral diarrhea" or "parenteral dyspepsia." Jeans and Floyd [19] raise the question whether cholera

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12. Sisson, W. R.: Critical Review of Intestinal Bacteriology in Relation to Certain Diarrheas of Infants, Boston M. & S. J. **178**:492, 1918.

13. Davison, W. C.: The Bacteriology of Diarrhea in Infants, South. M. J. **17**:552, 1924.

14. Porter, L.; Morris, G. B., and Meyer, K. F.: Certain Nutritional Disorders of Children Associated with a Putrefactive Intestinal Flora, Am. J. Dis. Child. **18**:254 (Oct.) 1919.

15. Bessau, G., and Bossert, O.: Zur Pathogenese der akuten Ernährungsstörungen: I. Mitteilung. Bakteriologie des Magens und Duodenums, II. Dyspepsien, Jahrb. f. Kinderh. **89**:213, 1919.

16. Marriott, W. M.; Davidson, L. T., and Harshman, L. P.: Studies on the Digestion in Infancy: I. Hydrogen ion Concentration of the Gastric Contents, Tr. Am. Pediat. Soc. **34**:39, 1922.

17. Davison, W. C.: Some Factors Which Affect Gastric Analysis in Infants, Am. J. Dis. Child. **30**:23 (July) 1925.

18. Davison, W. C.: The Duodenal Contents of Infants in Health and During and Following Diarrhea: Preliminary Report, Am. J. Dis. Child. **29**: 743 (June) 1925.

19. Jeans, P. C., and Floyd, M. L.: Upper Respiratory Infection as a Cause of Cholera Infantum, J. A. M. A. **87**:220 (July 24) 1926.

infantum, frequently considered an alimentary diarrhea, is not usually due to parenteral infection.

Recently functional theories have become prominent as offering an explanation of these types of diarrhea. Decrease of the acidity of the gastric secretion [16] and decrease in the enzymatic activity of the duodenal contents [18] have been suggested as factors in the development of diarrhea. In 1923, Marriott [20] proposed the theory that diarrhea was due to dehydration, but Brautusch-Marrain [21] offers evidence in refutation.

Whatever the exact nature of the condition, it seems reasonable to assume that it is not an infectious disease which runs a fairly definite course, like bacillary dysentery or paratyphoid fever. This is indicated by the wide variations in the duration of the diarrhea, and the fact that the condition is often relieved by putting the child on a rational dietetic regimen, or by eliminating a focus of parenteral infection.

In the present investigation, two methods were employed in an attempt to establish the relationship to the disease of an organism present in the diarrheal stools. The first was based on the theory of d'Herelle [22] that in disease, particularly in intestinal disease, a bacteriophage is developed by the body as a protective mechanism against the organism etiologically related to the condition. It was thought that while the bacteriophage is polyvalent in its action, its most marked and most constant action should be demonstrable on the micro-organism that forms the basis of the disease, and it should be most potent in the stools after recovery. The second method employed was that of repeated skin tests with the filtrates of eighteen hour broth cultures of each variety of organism from diarrheal stools. Two skin tests were made; one during the period of diarrhea, if possible, and the other after the stools had become normal. The rationale of this method is that the toxic substance produced by a fecal micro-organism etiologically related to the condition should elicit a positive skin reaction during the period when the child is not protected by antibodies against the poison (while the diarrhea persists) and a negative skin reaction as soon as sufficient antibodies have developed to neutralize the toxic filtrate. The presence of sufficient antibody protection would be indicated clinically, it was presumed, by the stools becoming normal. Agglutination tests were also made with the patient's serum on the bacteria isolated from the diarrheal stools. The investigation was carried out on patients with cases of diarrhea with pus, blood and mucus in the stools who were admitted to the Cleveland City Hospital, the Lakeside Hospital, and the

20. Marriott, W. M.: Zur Kenntnis der Ernährungsstörungen des Säuglingsalters, Monatschr. f. Kinderh. **25**:426, 1923.

21. Brautusch-Marrain, A.: Zur Pathogenese der Cholera Infantum, Arch. f. Kinderh. **78**:246, 1926.

22. d'Herelle, F.: The Bacteriophage; Its Rôle in Immunity, Baltimore, Williams & Wilkins, 1922.

Babies Dispensary and Hospital during the summer of 1925, and on those admitted to the Babies and Children's Hospital during the summer of 1926.

INCIDENCE OF BACTERIOPHAGE IN NORMAL AND DIARRHEAL STOOLS

Method.—About 1 cc. of the stool was introduced into a tube of broth and thoroughly mixed by means of a shaker. A loopful of the suspension was then streaked on two plates of medium. In the series of 1925, Endo medium was used; the plates were incubated for twenty-four hours, and colonies were isolated after being examined with the naked eye and identified in the usual manner. In the series of 1926, eosin-methylene-blue agar[23] was used, and after incubation for twenty-four hours, the colonies were examined both with the naked eye and with the low power microscope. There is much to be said in favor of the procedure of isolating organisms employed in the latter series. Differences in colonies not evident to the naked eye, but distinct under the microscope, were frequently borne out by cultural variations. Each isolated strain of organism was labeled with the patient's initials followed by a number, and it is referred to in the tables with this designation; thus, the strains isolated from the first stool obtained from D. C. are designated DC1, DC2, etc. The strains from the second stool are prefixed by the number 2, those from the third stool by the number 3; thus, those from the second stool obtained from D. C. are designated 2DC1, 2DC2, etc. For the sake of facilitating reference to strains of *B. coli* which varied culturally, they are grouped under eight headings according to the combinations of reactions which were obtained in indol and carbinol and on blood plates.

	Indol	*Carbinol*	*Hemolysis*
1.	+	—	+
2.	+	+	+
3.	+	—	—
4.	+	+	—
5.	—	—	+
6.	—	+	+
7.	—	—	—
8.	—	+	—

A culture of each stool was also made by inoculating a flask of broth with several loopfuls of the stool suspension in broth; this was incubated for from eighteen to twenty-four hours at room temperature, and filtered through French candle filters (L2 and L3).

For the bacteriophage test, suspensions of the organism to be tested were made in broth and 0.5 cc. of the suspension was introduced on to an agar slant. The slant was tipped from side to side until the whole of its surface was moistened by the bacterial suspension; the excess was then poured off, and the tubes were placed in the incubator (37 C.) for two or three hours. At the end of this time, 0.5 cc. of the stool filtrate was introduced on to the slants already seeded with the organisms to be tested; the whole surface was moistened, and the excess poured off as when inoculations were made. As a control, each organism was inoculated in duplicate, and the procedure carried through in the same way except that broth was substituted for the filtrate to be tested. The cultures were then incubated at room temperature over night, and the results read the next day.

The estimation of the effect manifested by the bacteriophage in clear areas in an even growth of bacterial colonies is arbitrary, of course. Lysis of all

23. Levene, M.: Bacteria Fermenting Lactose and Their Significance in Water Analysis, Bull. Iowa State College of Agriculture and Mechanical Arts **20**:117, 1909.

the bacterial colonies leaving the whole surface of the slant clear is indicated by four plus; lysis of roughly three fourths of the colonies (as compared with the control), by three plus; lysis of roughly one-half, by two plus, and of roughly one-fourth, by one plus. Scattered but definite clear spots the estimated combined areas of which constitute less than one quarter of the area of bacterial growth on the control slant are indicated by plus-minus.

The stool culture filtrates of each patient were tested on each variety of organism isolated from his stools and also on a stock strain of *B. coli-communis* (designated "Y coli") which is known to be susceptible to the action of bacteriophage.

TABLE 1.—*Bacteriophage in Normal Stools*

Patient	Diagnosis	Date of Stools	Bacteriophage Action
Rv. B., M.; age, 3 wks.	Otitis media	2/ 2/27	0 on all tested bacteria
		2/ 8/27	0 on all tested bacteria
D. C., M.; age, 1 mo.	Disturbed balance, prematurity	1/ 8/27	± 2DC3 — B. coli-communis I
			± Y coli — B. coli-communis
		1/23/27	± DC1 — B. coli-communis I
			± 2DC2 = B. coli-communis II
			± Y coli — B. coli-communis I
S. T., M.; age, 4½ mo.	No disease	1/ 8/27	0 on all tested bacteria
		1/23/27	0 on all tested bacteria
M. K., F.; age, 4 mo.	Otitis media, pyelitis	1/ 6/27	0 on all tested bacteria
		1/24/27	0 on all tested bacteria
R. A., F.; age, 5 mo.	Cervical adenitis	9/19/26	0 on all tested bacteria
		10/ 4/26	0 on all tested bacteria
E. T., F.; age, 5 mo.	Spina bifida	1/ 8/27	0 on all tested bacteria
		1/23/27	0 on all tested bacteria
G. B., M.; age, 5 mo.	Hilic tuberculosis	8/24/25	0 on all tested bacteria
Y. D., F.; age, 6 mo.	Disturbed balance	8/21/26	0 on all tested bacteria
		8/30/26	0 on all tested bacteria
F. G., M.; age, 11 mo.	Bronchopneumonia, pyelitis	1/24/27	0 on all tested bacteria
		2/ 3/27	0 on all tested bacteria
C. J., M.; age, 12 mo.	Rickets, otitis media	1/ 8/27	0 on all tested bacteria
		2/ 8/27	0 on all tested bacteria
R. T., M.; age, 12 mo.	Rickets, otitis media	1/23/27	0 on all tested bacteria
		2/ 2/27	0 on all tested bacteria
C. W., M.; age, 5 yrs.	Diastasis of recti	8/19/26	± CW1 — B. coli-communis VI
			++ CW2 — B. coli-communior I
			+ Y coli —
		8/27/26	+ 2CW1 — B. coli-communis I
			± 3CW3 — B. coli-aerogenes
			± 3CW4 — B. coli-communior II
			± Y coli —
		8/31/26	± CW3 — B. coli-communis II

Bacteriophage in Normal Stools.—The pertinent facts and the results of the bacteriophage tests on normal stools are shown in table 1.

Only two of the twelve patients whose normal stools were examined for bacteriophage showed lytic activity. On Jan. 8, 1927, the stool from D. C. contained bacteriophage active on 2DC3, a strain of *B. coli-communis* I, which was isolated from the later stool; it was also active on the Y coli, but not on any of the organisms isolated from the same stool from which the bacteriophage itself was obtained. On Jan. 23, 1927, the culture filtrate of the later stool contained bacteriophage active on DC1, a strain of *B. coli-communis* I from the earlier stool, on the Y coli and on 2DC2, a strain of *B. coli-communis* II occurring in the same stool from which the bacteriophage was obtained.

TABLE 2.—*Bacteriophage in Diarrheas of Known Etiology*

Patient	Diagnosis	Duration of Diarrhea	Date of Stool	Bacteriophage Action	Outcome
R. M., M.; age, 5 mo.	Bacillary dysentery (Flexner)	9/13—10/7	9/29	D..... (B. dysenteriae isolated) 0 on all tested bacteria	Death 10/7
			10/4	D ± RM2 — B. dysenteriae (Flexner) ± 2RM1 — B. coli-communis I ± Y coli — B. coli-communis I	
J. B., F.; age, 9 mo.	Bacillary dysentery (Flexner)	8/15—10/9	8/30	D..... (B. dysenteriae isolated) ± JB2 — B. coli-communis I + JB5 — B. dyenteriae (Flexner) ± 2JB2 — B. coli-communis I ++ 4JB3 — B. coli-aerogenes ++ Y coli —	Recovery
			9/8	D ± JB3 — B. coli-communis II + JB5 — B. dyenteriae (Flexner) + 3JB1 — B. coli-aerogenes + 4JB2 — Enterococcus ± Y coli —	
			9/17	D + JB5 — B. dyenteriae (Flexner) ± 2JB4 — B. coli-communior II + 3JB1 — B. coli-aerogenes ± Y coli —	
			9/25	D (B. dysenteriae isolated) + JB5 — B. dyenteriae (Flexner) ± 2JB5 — B. coli-communis IV ± 3JB1 — B. coli-aerogenes ± Y coli —	
M. S., M.; age, 12 mo.	Bacillary dysentery (Flexner)	9/19—10/7	9/29	D..... (B. dyenteriae isolated)	Recovery
			10/4	D 0 on all tested bacteria	
			10/14	N 0 on all tested bacteria	
G. W., M.; age, 14 mo.	Bacillary dysentery (Flexner)	10/2 —10/15	10/12	D..... (B. dysenteriae isolated) 0 on all tested bacteria	Recovery
			10/16	N ± GW2 — B. dysenteriae (Flexner) ± 2GW1 — B. coli-communior ± Y coli —	
M. J., M.; age, 20 mo.	Bacillary dysentery (Hiss-Russell-Y)	7/7 — 8/6	7/18	D..... 0 on all tested bacteria	Recovery
			7/21	D (B. dysenteriae isolated) ± 2MJ1 — B. dysenteriae. Hiss-Russell-Y ± Y coli —	
			8/5	D ± 2MJ1 — B. dysenteriae. Hiss-Russell-Y ± Y coli —	
			9/14	N ± 2MJ1 — B. dysenteriae. Hiss-Russell-Y. ± Y coli —	
W. E., M.; age, 4 yrs.	Bacillary dysentery (Flexner)	8/3 — 8/20	8/17	D..... 0 on all tested bacteria	Recovery
			8/20	D (B. dysenteriae isolated) 0 on all tested bacteria	
J. K., M., age, 5 mo.	Paratyphoid B. fever	7/20— 8/13	8/5	D..... 0 on all tested bacteria	Recovery
			8/12	D (B. paratyphosus B. isolated) 0 on all tested bacteria	
			8/20	N 0 on all tested bacteria	
J. J., M.; age, 7 mo.	Paratyphoid B. fever	8/25— 9/10	8/28	D..... 0 on all tested bacteria	Recovery
			9/10	D (B. paratyphosus B. isolated) 0 on all tested bacteria	
C. H., F.; age, 11 mo.	Paratyphoid B. fever	8/24— 9/17	8/18	D..... 0 on all tested bacteria	Recovery
			9/10	D (B. paratyphosus B. isolated) 0 on all tested bacteria	
			10/1	N 0 on all tested bacteria	
W. T., M.; age, 2 yrs.	Paratyphoid B. fever	8/11— 9/2	8/18	D..... 0 on all tested bacteria	Recovery
			8/20	D (B. paratyphosus B. isolated) 0 on all tested bacteria	
			8/24	D (B. paratyphosus B. isolated) 0 on all tested bacteria	
			9/3	N 0 on all tested bacteria	

TABLE 3.—*Bacteriophage in Cases of Diarrhea of Unestablished Etiology*

Patient	Diagnosis	Duration of Diarrhea	Date of Stool	Bacteriophage Action	Outcome
R. S., F.; age, 2 weeks	Prematurity, follicular enteritis	7/18— 8/20	8/12	D — O on all tested bacteria.....	Death 8/20
			8/19	D — O on all tested bacteria	
B. K., F.; age, 2 weeks	Prematurity, follicular enteritis	8/21— 9/2	8/24	D — O on all tested bacteria.....	Death 9/2
			9/1	D — O on all tested bacteria.....	
R. J., F.; age, 4 mos.	Follicular enteritis	8/20— 9/2	8/24	D — ± RJ1 — B. coli-aerogenes.....	Recovery
				± RJ1 — B. coli-aerogenes	
				± RJ4 — B. coli-communis	
				±2RJ3 — B. coli-aerogenes	
			9/4	N — O on all tested bacteria	
J. M., M.; age, 5 mos.	Follicular enteritis,	8/6 — 8/17	8/7	D — O on all tested bacteria.....	Recovery
			8/20	N — O on all tested bacteria	
E. C., M.; age, 5 mos.	Follicular enteritis, nasopharyngitis	9/12— 9/23	9/16	D — O on all tested bacteria.....	Recovery
			9/30	N — O on all tested bacteria	
C. H., F.; age, 6 mos.	Follicular enteritis, pyelitis	8/6 — 8/21	8/8	D — O on all tested bacteria.....	Recovery
			8/31	N — O on all tested bacteria	
J. B. M.; age, 6 mos.	Follicular enteritis	8/22— 9/8	8/28	D — O on all tested bacteria.....	Recovery
			9/10	N — O on all tested bacteria	
J. D., F.; age, 6 mos.	Follicular enteritis, nasopharyngitis	9/14— 9/29	9/16	D — ± JD1 — B. coli-aerogenes.....	Recovery
				± JD2 — B. coli-communis	
				+ Y coli — B. coli-communis I	
			9/30	N — ± JD1 — B. coli-aerogenes	
				± JD2 — B. coli-communis	
				+ 2JD1 — C. coli-communior	
				± Y coli —	
W. C., M.; age, 7 mos.	Follicular enteritis, nasopharyngitis	9/5 — 9/14	9/10	D — 2WC6 — B. coli-communis.....	Recovery
				± Y coli —	
			9/16	N — ± WC5 — B. coli-aerogenes	
				± 2WC6 — B. coli-communis	
				± 2WC6 — B. coli-communis	
				± Y coli —	
F. R., F.; age, 8 mos.	Follicular enteritis, pyelitis	7/20— 8/1	7/23	D — O on all tested bacteria.....	Recovery
			8/6	N — O on all tested bacteria	
R. McG., F.; age, 9 mos.	Diarrhea with intoxication, ulcerative stomatitis, rickets	9/11— 9/21	9/16	D — ± RMcG3 — B. coli-aerogenes.....	Recovery
				± 2RMcG3 — B. coli-communior	
				± Y coli —	
			9/22	N — + RMcG1 — B. coli-communior	
				+ RMcG3 — B. coli-aerogenes	
				± 2RMcG3 — B. coli-communior	
				± Y coli —	
D. T., F.; Age, 9 mos.	Follicular enteritis, vaginitis	9/3 — 9/14	9/10	D — ± DT1 — B. coli-communior.....	Recovery
				+ 2DT1 — B. coli-aerogenes	
				± Y coli —	
			9/17	N — ± 2DT1 — B. coli-aerogenes	
				± 2DT2 — B. coli-communior	
J. G., M.; age, 11 mos.	Follicular enteritis, otitis media	? — 8/17	8/5	D — O on all tested bacteria.....	Recovery
			8/17	D — O on all tested bacteria	
			8/20	N — O on all tested bacteria	
D. D., F.; age, 11 mos.	Follicular enteritis cystitis	7/26— 8/19	8/1	D — O on all tested bacteria.....	Death 8/19
			8/17	D — ± DD1 — B. coli-aerogenes	
				± 2DD1 — B. coli-aerogenes	
				± Y coli —	
J. Z., M.; age, 12 mo.	Follicular enteritis, rickets	8/11— 8/26	8/24	D — O on all tested bacteria.....	Recovery
				N — O on all tested bacteria	
N. M., F.; age, 14 mo.	Follicular enteritis	9/ 4— 9/15	9/9	D — O on all tested bacteria.....	Recovery
			9/16	N — ++ NM1 — B. coli-communis	
				± NM2 — Enterococcus	
				+++ Y coli —	
K. G., F.; age, 2 yrs.	Follicular enteritis	9/ 8— 9/14	9/10	D — O on all tested bacteria.....	Recovery
			9/16	N — O on all tested bacteria	
J. S., M.; age, 3 yrs.	Follicular enteritis	7/ 8— 7/18	7/17	D — O on all tested bacteria.....	Recovery
			7/24	N — O on all tested bacteria	

TABLE 4.—*Bacteriophage in Cases of Diarrhea of Unestablished Etiology*

Patient	Diagnosis	Duration of Diarrhea	Date of Stool	Bacteriophage Action	Outcome
1. J., F.; age, 14 days	Infectious diarrhea, otitis media, pyelitis	8/24—10/12	8/30	D — O on all tested bacteria.....	Recovery
			9/21	D — O on all tested bacteria	
			10/15	N — O on all tested bacteria	
A. K., F.; age, 2 mos.	Infectious diarrhea	8/12— 8/20	8/17	D — ± AK1 — B. coli-communis I.....	Recovery
				± AK2 — B. coli-communis IV	
				± AK3 — B. coli-communis II	
				± 2AK2 — B. coli-communis V	
				± Y coli — coli-communis I	
			8/21	N — ± AK2 — B. coli-communis IV	
				± AK3 — B. coli-communis II	
				± AK4 — B. coli-aerogenes	
				+ 2AK1 — B. coli-communis I	
				++ 2AK2 — B. coli-communis V	
				± Y coli —	
E. M., F.; age, 4 mos.	Infectious diarrhea, pyelitis	8/15— 8/31	8/27	D — O on all tested bacteria.....	Recovery
			8/30	D — O on all tested bacteria	
			9/17	N — O on all tested bacteria	
R. T., M.; age, 4 mos.	Infectious diarrhea, otitis media, rickets	9/30—10/ 6	10/ 4	D — O on enterococcus (only organism isolated)	Death 10/6
				+++ Y coli —	
D. B., M.; age, 5 mos.	Infectious diarrhea, otitis media	9/27—10/ 6	9/29	D — + DB1 — B. coli-communis I.....	Recovery
				+ 3BD2 — enterococcus	
				+ Y coli —	
			10/ 4	D — ++ DB1 — B. coli-communis I	
				± 3DB2 — enterococcus	
				++ Y coli —	
			10/26	N — ± DB1 — B. coli-communis I	
				± Y coli —	
A. H., M.; age, 8 mos.	Diarrhea—unqualified, nasopharyngitis, otitis media	9/24—10	10/ 4	D — ± AH1 — B. coli-communior II....	Recovery
				+ AH2 — B. coli-communior I	
				± Y coli —	
			10/26	N — O on all tested bacteria	
J. W., F.; age, 8 mos.	Infectious diarrhea, nasopharyngitis, pyelitis	9/16— 9/21	9/17	D — O on all tested bacteria.....	Recovery
			9/29	N — O on all tested bacteria	
F. L., F.; age, 9 mos.	Infectious diarrhea, otitis media, lobar pneumonia	9/20—11/ 9	9/30	D — O on all tested bacteria.....	Recovery
			11/14	N — O on all tested bacteria	
J. H., M.; age, 10 mos.	Infectious diarrhea	10/ 2—10/ 6	10/ 4	D — O on all tested bacteria.....	Recovery
			10/19	N — O on all tested bacteria	
F. J., M.; age, 10 mos.	Infectious diarrhea, otitis media	9/15—10/ 6	9/29	D — ± FJ2 — B. coli-communior I.....	Recovery
				± Y coli —	
			10/ 6	N — O on all tested bacteria	
E. H., M.; age, 18 mos.	Infectious diarrhea	9/10— 9/24	9/19	D — O on all tested bacteria.....	Recovery
			10/ 6	N — O on all tested bacteria	
F. A., M.; age, 18 mos.	Infectious diarrhea	9/ 5— 9/10	9/ 9	D — + FA1 — B. coli-communis II.....	Recovery
				± 2FA1 — B. coli-aerogenes	
				± 2FA3 — B. coli-communis IV	
			9/19	N — ± 2FA3 — B. coli-communis IV	
				± Y coli —	
J. M. F.; age, 24 mos.	Infectious diarrhea, nasopharyngitis, otitis media	10/15—10/20	10/16	D — ± JM3 — B. coli-communior V.....	Recovery
				± Y coli —	
			10/26	N — ± JM3 — B. coli-communior V	
P. B., M.; age, 30 mos.	Infectious diarrhea	9/9 — 9/26	9/17	D — O on all tested bacteria.....	Recovery
				D — O on all tested bacteria	
			10/6	N — O on all tested bacteria	
R. B., M.; age, 6 yrs.	Infectious diarrhea	8/15— 8/29	8/17	D — O on all tested bacteria.....	Recovery
			8/21	D — O on all tested bacteria	
			8/30	N — ± RB3 — B. coli-communis I	
				+ 2RB3 — B. coli-communior VI	
				± 2RB4 — B. coli-aerogenes	
				+ 2RB5 — B. coli-communior II	
				± 3RB3 — B. coli-communior II	
				++ Y coli —	

The same type of action was found in the stools of C. W. Here the lytic action of the bacteriophage was demonstrable on strains of *B. coli-communis, B. coli-communior* and *B. coli-aerogenes* from the same, preceding and subsequent stools, as well as on the Y coli. It should be noted here that although the bacteriophage could be demonstrated in each stool, not a single stool organism was acted on in common by the three specimens of bacteriophage.

In this short series of controls, the bacteriophage was present in the normal stools of two of twelve children. Its activity was manifested on organisms isolated from the same, preceding, or subsequent stools of the same patient, and also on certain organisms obtained from other sources.

The Bacteriophage in Diarrhea of Known Etiology.—As a further control, the incidence and range of action of the bacteriophage was investigated in stools of patients with diarrhea of known bacterial etiology. These results are shown in table 2. In this and the following tables, *D* signifies a diarrheal stool, and *N* a normal one.

Of the six cases of bacillary dysentery, bacteriophage activity could be demonstrated with the stool culture filtrates of four. In each case the strain of *B. dysenteriae* isolated from the patient's stools was acted on; but, except in the case of M. J., the other fecal bacteria from the same patient were acted on to a more marked degree. One of the four patients whose stools contained bacteriophage died; the two whose stools did not contain bacteriophage recovered.

Four patients with paratyphoid B. infections did not have demonstrable bacteriophage in their stools at any time. They all recovered.

The Bacteriophage in Diarrhea of Unestablished Etiology.—The cases in which there was definite evidence in the stools of an inflammatory lesion in the intestines fall naturally into two groups. The first group occurred in the summer of 1925; the second, in the summer of 1926. Table 3 shows the results of the investigation in the first group, and table 4 those of the second group.

Of the thirty-three patients with diarrhea of unestablished etiology whose stools contained blood, pus and mucus, bacteriophage effect could be demonstrated in the stool culture filtrates of fifteen. In seven the bacteriophage was obtained from only one stool, and its action was polyvalent. In the remaining eight the lytic agent could be demonstrated in two or more filtrates from stool culture; but there was no constancy of action on only one organism isolated from the diarrheal stool, and the number of cases studied is too small to allow one to draw any conclusions concerning the etiologic relationship of any organism in the stool to the disease. Two of the fifteen patients whose stools contained bacteriophage died, as did two of the eighteen whose stools did not contain this agent.

CONCLUSIONS

1. In this series the incidence of the bacteriophage in the stools of children with diarrhea of unestablished etiology is greater (45 per cent) than in children with normal stools (16 per cent).

2. The action of the bacteriophage obtained from the stools of these patients did not give any indication of the possible etiologic relationship to the disease of any organism isolated from the diarrheal stools.

3. There is no parallelism between the occurrence of the bacteriophage in the stools and the clinical condition of the patient or the outcome of the disease.

SKIN REACTIONS OF CHILDREN WITH DIARRHEA TO FILTRATES OF THE ORGANISMS ISOLATED FROM THEIR STOOLS

Method.—The organisms were isolated from the stool on eosin-methylene-blue plates after examination by the naked eye and also after examination with the low power microscope in the manner described in the first part of this paper. They were inoculated directly from the plate into flasks of broth, incubated for eighteen hours at 37 C. and filtered through French candle (L2 and L 3) or Berkefeld "N" filters. The same results were obtained with the two types of filter; hence they were used interchangeably. The filtrates were all tested for sterility by incubation at 37 C. over night. The skin tests were performed in the usual way by the intracutaneous injection of 0.1 cc. of the sterile filtrate. The sites of injection were either the flexor surface of the forearm or the lateral surface of the thigh. A control injection of broth was made in every series of tests.

The tests were read in from eighteen to twenty-four hours. It was found that in a strongly positive reaction (++) the reddening and induration were marked in about eighteen hours. After twenty-four hours or more, the swollen area took on a brown tint; the induration became a little more marked, and then gradually disappeared, and a brown discolored spot remained for three or four days.

The reactions were graded two plus for a strongly positive reaction with marked induration and redness; one plus for a positive reaction with definite induration and redness; plus-minus for redness without induration after twenty-four hours, and "0" for no reaction.

Skin Reactions in Children with Normal Stools to Filtrates of Organisms Isolated from Their Stools.—The first series of control tests was made on ten children who had normal stools. Each variety of organism isolated from two stools was grown in broth for eighteen hours, and the sterile filtrates were tested on the patient. A week or more later, the same tests were repeated.

Table 5 shows the results obtained in children whose stools were normal. In most cases, only a slight reddening was produced at the site of the injection; in a fair number, a definite positive reaction occurred. The noteworthy result, however, is the fact that the reactions to the individual filtrates were essentially the same on both the first and the second injections.

TABLE 5.—*Skin Reactions of Patients with Normal Stools to Filtrates of Organisms Isolated from Their Stools*

Patient	Diagnosis	Date of Stool	Stool Bacteria	Skin Reactions	
				2/15	2/22
Rv. B., M.; age, 3 weeks	Prematurity, otitis media	2/2	RvB1 — B. coli-communior I	+	+
			RvB2 — B. coli-communior II	+	+
			RvB3 — Enterococcus	—	—
		2/8	2RvB1 — B. coli-aerogenes	—	—
				1/30	2/7
D. C., M.; age, 1 mo.	Prematurity, disturbed balance	1/8	DC1 — B. coli-communis I	+	+
			DC2 — B. coli-aerogenes	—	—
		1/23	2DC2 — B. coli-communis II	+	+
			2DC4 — Enterococcus	—	—
				1/30	2/7
M. K., F.; age, 4 mos.	Otitis media, pyelitis	1/16	MK1 — B. coli-communis VIII	—	—
			MK2 — B. coli-aerogenes	—	—
			MK3 — B. coli-communior II	±	±
		1/24	2MK1 — B. coli-communior I	+	+
				1/30	2/7
S. T., M.; age, 4½ yrs.	No disease	1/8	ST1 — B. coli-communior I	±	±
			ST2 — B. coli-communis III	+	+
			ST3 — B. coli-aerogenes	±	±
		1/23	2ST1 — B. coli-communior IV	+	+
			2ST2 — Enterococcus	—	—
				1/27	2/2
E. T., F.; age, 5 mos.	Spina bifida	1/8	ET1 — B. coli-communis I	±	±
		1/23	2ET1 — B. coli-communis II	±	—
			2ET2 — Enterococcus	—	—
				9/26	10/4
R. A., F.; age, 5 mos.	Tonsillitis, abscess of cervical nodes	9/19	RA1 — B. coli-communis II	+	+
			RA2 — B. coli-communis I	+	+
			RA3 — B. coli-communior III	—	—
				1/30	2/9
F. G., M.; age, 11 mos.	Otitis media, bronchopneumonia	1/24	FG1 — B. coli-aerogenes	±	±
			FG2 — B. coli-communior I	±	±
			FG3 — B. coli coli-communior III	±	±
				2/12	2/20
C. J., M.; age, 12 mos.	Rickets, otitis media	1/8	CJ1 — B. coli-communior II	±	±
			CJ2 — B. coli-communior I	±	±
		2/8	2CJ3 — B. coli-aerogenes	—	—
				2/12	2/19
R. Tr., M.; age, 12 mos.	Rickets, otitis media, pharyngitis	1/23	RTr1 — B. coli-communior II	±	±
			RTr2 — Enterococcus	±	—
		2/2	2RTr1 — B. coli-communior VII	±	±
			2RTr2 — B. coli-aerogenes	—	—
				8/22	8/31
C. W., M.; age, 5 years.	Diastasis of recti	8/19	CW1 — B. coli-communis VI	±	±
			CW2 — B. coli-communior I	±	±
			CW3 — B. coli-communis IV	±	±
			CW4 — Enterococcus	±	±

TABLE 6.—*Skin Reactions in Bacillary Dysentery and Typhoid Fever to Culture Filtrates of Organisms Isolated from the Stools*

Patient	Diagnosis	Duration of Diarrhea	Date of Stool	Stool Organisms	Skin Reactions	
					10/4	10/14
R. M., M.; age, 5 mos.	Bacillary dysentery (Flexner)	9/13—10/7	9/29	RM1 — B. coli-communior I	+	+
				RM2 — B. dysenteriae (Flexner)	++	—
				RM3 — B. coli-communior II	—	—
				RM4 — B. coli-aerogenes	—	—
				RM5 — B. coli-aerogenes V	+	+
					9/8	9/22
J. B., F., age, 9 mos.	Bacillary dysentery (Flexner)	8/23 ± 10/9	8/30	JB1 — B. coli-communior II	++	++
				JB2 — B. coli-communior I	++	++
				JB3 — B. coli-communis II	++	++
				JB4 — B. coli-aerogenes II	—	—
				JB5 — B. dysenteriae (Flexner)	+	—
					10/4	10/11
M. S., M.; age, 1 yr.	Bacillary dysentery (Flexner)	9/19—10/7	9/29	MS1 — B. coli-aerogenes II	—	—
				MS2 — B. dysenteriae (Flexner)	++	—
			10/4	2MS1 — Enterococcus	++	++
				2MS2 — B. coli-communior V	+	+
				2MS3 — B. coli-aerogenes	—	—

TABLE 7.—*Skin Reactions of Children with Diarrhea of Unestablished Etiology to Culture Filtrates of Organisms Isolated from Their Stools*

Patient	Diagnosis	Duration of Diarrhea	Date of Stool	Stool Organisms	Skin Reactions	
					9/4	9/21
I. J., F.; age, 14 days	Infectious diarrhea, otitis media, pyelitis	8/30— 9/12	8/30	IJ1 — B. coli-communis II	++	—
				IJ2 — B. coli-communis IV	+	+
				IJ3 — B. coli-communis I	++	++
					8/20	8/29
A. K., F.; age, 2 mos.	Infectious diarrhea	8/12— 8/21	8/17	AK1 — B. coli-communis I	—	—
				AK2 — B. coli-communis IV	+	+
				AK3 — B. coli-communis II	++	±
				AK4 — B. coli-aerogenes	—	—
				AK5 — B. coli-communis III	—	—
					8/30	9/4
E. M., F.; age, 4 mos.	Infectious diarrhea, pyelitis	8/15— 9/2	8/27	EM1 — B. coli-communior II	++	—
				EM2 — B. coli-communior IV	—	—
				EM3 — B. coli-aerogenes	—	—
				EM4 — B. coli-communis II	+	+
					10/4	10/21
D. B., M.; age, 5 mos.	Infectious diarrhea, pyelitis, otitis media	9/27—10/6	9/29	DB1 — B. coli-communis I	++	—
				DB2 — B. coli-aerogenes II	+	+
				DB3 — B. coli-aerogenes	—	—
					9/20	10/11
J. W., F.; age, 8 mos.	Infectious diarrhea, pyelitis, nasopharyngitis	9/16— 9/21	9/17	JW1 — B. coli-aerogenes	±	±
				JW2 — B. coli-communis III	+	+
				JW3 — B. coli-communis I	++	—
				JW4 — B. coli-communis II	+	+
					10/4	11/14
F. L., F.; age, 9 mos.	Infectious diarrhea, otitis media lobar pneumonia	9/20—11/9	9/30	FL1 — B. coli-communis I	+	+
				FL2 — B. coli-communis II	++	±
				FL3 — B. coli-aerogenes	±	±
				FL4 — B. fecalis alcaligenes	++	++
				FL5 — B. coli-communior IV	+	+
					10/8	10/19
J. H. M.; age, 10 mos.	Infectious diarrhea,	10/2—10/6	10/4	JH1 — B. coli-communior IV	—	—
				JH2 — B. fecalis alcaligenes	++	++
				JH3 — B. coli-communior III	+	+
				JH4 — B. coli-aerogenes	—	—
				JH5 — B. coli-communior I	+	+
					10/2	10/16
F. J., M.; age, 10 mos.	Infectious diarrhea, otitis media	9/15—10/16	9/29	FJ1 — B. coli-communior I	+	+
				FJ2 — B. coli communior V	++	±
				FJ3 — B. proteus vulgaris	+	+
				FJ4 — B. coli-aerogenes	+	+
				FJ5 — B. fecalis alcaligenes	+	+
					9/12	9/19
F. A., M.; age, 18 mos.	Infectious diarrhea, rickets	9/7—9/10	9/9	FA1 — B. coli-communis II	+	+
				FA2 — B. coli-communis IV	—	—
				FA3 — Enterococcus	+	+
					9/23	9/30
E. H., M.; age, 18 mos.	Infectious diarrhea	9/10—9/24	9/19	EH1 — B. coli-aerogenes	—	—
				EH1a — B. coli-communior VII	+	—
				EH2 — B. coli communior I	+	+
				EH3 — B. coli-communior II	+	+
				EH4 — B. coli-communior III	—	—
					10/20	10/30
J. M., F.; age, 2 yrs.	Infectious diarrhea, nasopharyngitis, otitis media	10/15—10/23	10/16	JM1 — B. coli-communior II	+	+
				JM2 — B. coli-communis III	++	++
				JM3 — B. coli-communior V	+	—
					9/21	9/30
P. B., M.; age, 2½ yrs.	Infectious diarrhea	9/9—9/26	9/17	PB1 — B. coli-communior VI	—	—
				PB2 — B. coli-communior II	+	+
				PB3 — B. coli-communior I	++	—
				PB4 — B. coli-aerogenes	—	—
				PB5 — B. coli-communior IV	±	±
					8/24	8/30
R. B., M.; age, 6 yrs.	Infectious diarrhea	8/15—8/29	8/17	RB1 — B. coli-communior I	+	+
				RB2 — B. coli-communis VII	+	+
				RB3 — B. coli-communis I	—	—
				RB3a — Enterococcus	—	—
				RB5 — B. coli-communis II	++	—
				RB7 — B. coli-communis III	+	+
				RB8 — B. coli-aerogenes	—	—

Skin Reactions in Bacillary Dysentery and Typhoid Fever to Organisms Isolated from the Stools.—The second series of control tests was made on three children with bacillary dysentery. The results of these injections are shown in table 6.

These patients gave positive skin reactions to culture filtrates of *B. dysenteriae* early in the disease and negative reactions on the later test. There were other organisms in the stools which gave as marked or even more marked reactions than *B. dysenteriae,* but the reaction to these in the second test was the same as it was in the original test.

Skin Reactions of Children with Diarrhea of Unestablished Etiology to the Filtrates of Organisms Isolated from Their Stools.—Skin tests with broth culture filtrates of organisms isolated from the diarrheal stools which contained blood, pus and mucus were made on thirteen patients. The significant facts in each case are given in table 7.

The stools of these patients always contained several organisms whose culture filtrates gave a positive skin reaction both during the period of diarrhea and after the stools had become normal. In eleven cases, however, there was one strain of *B. coli* which elicited a positive reaction in the first test and a negative one in the second test. This phenomenon is similar to that seen in the three cases of bacillary dysentery in table 6. In these cases some organisms were always found in the stool whose culture filtrates evoked a positive reaction in the skin but that of *B. dysenteriae* was the only one whose injection was followed by a positive reaction early in the disease and a negative reaction later. If culture filtrates of the other organisms gave any positive skin reactions, they gave them in both tests.

In two cases, those of J. H. and F. A., the skin reactions were the same each time the tests were made, but in these cases there was not enough time to get the filtrates ready and to perform the tests before the diarrhea had stopped. The skin of F. A. gave a negative reaction to F.A.2, a strain of *B. coli-communis* IV, and a positive reaction to the other organisms both times. The skin of J. H. gave consecutive negative reactions to JH4, a strain of *B. coli-aerogenes* of a type which seldom elicited a positive skin reaction in the other cases, and to JH1, a strain of *B. coli-communis* IV of a type which frequently produced a positive skin reaction. It is conceivable that in each of these cases a positive reaction might have been obtained if the filtrate of *B. coli-communis* IV had been tested during the period of diarrhea.

The organisms whose broth culture filtrates evoked a positive skin reaction while the diarrhea lasted and a negative one after it had stopped were either *B. coli-communis* or *B. coli-communior. B. coli* giving the same cultural reactions as these were found in normal stools.

The relative virulence of the various strains of *B. coli* isolated from the diarrheal stools of four patients was tested on rabbits and on guinea-

pigs by intravenous injection of the broth culture filtrates. In each case it was found that the minimum lethal dose of the toxic substance produced by a strain that gave a positive and then a negative skin reaction was always greater than were the minimum lethal doses of the substance produced by some of the other strains that had given the same skin reaction on both tests. Whether these organisms are nevertheless more virulent for human beings than the other strains of *B. coli* in the stool is a matter of speculation. It seems more likely that they are ordinary stool *B. coli* which may be harmful to the patient if his resistance is lowered by heat and humidity, parenteral infection or some other obscure factor.

Agglutination tests were carried out for the stool organisms with the patient's serum in each case of diarrhea, but agglutination was not obtained in dilutions of 1:16 or more, except in cases of bacillary dysentery. The inability to demonstrate agglutination for the strains of *B. coli* that gave positive and then negative skin reactions is not surprising, since it is an established fact that many strains of *B. coli* do not stimulate the production of agglutinins experimentally.

SUMMARY AND CONCLUSIONS

1. In eleven children with diarrhea of unestablished etiology whose stools contained pus, blood and mucus, a positive skin reaction was obtained to the broth culture filtrates of one or more strains of *B. coli* which had been isolated from the diarrheal stool. After the stools became normal, the skin reaction became negative to one of these strains but continued to be positive to all others which had previously been positive. The strains that gave negative reactions during the disease remained negative subsequently.

2. The strains of *B. coli* that gave these skin reactions varied culturally. They were of the communis type in six cases and of the communior type in five. The individual strains of the same type showed slight cultural variations.

3. The serums of these patients uniformly failed to agglutinate the bacteria.

PROPHYLAXIS OF VARICELLA WITH VESICLE FLUID*

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Recently a child in the wards developed varicella. It was desirable to safeguard all exposed children in order to shorten the period of quarantine and to protect the several very ill children from the additional strain incident to chickenpox.

Greenthal's [1] report states that of thirty-six exposed persons who were vaccinated from the vesicle fluid of a patient suffering from varicella, nineteen gave positive reactions and sixteen negative reactions. In his series of cases, varicella did not develop in those persons who were vaccinated, successfully or unsuccessfully. With his observations in mind, it seemed probable that there might be equal success in preventing the spread of varicella in the wards. After a negative Wassermann reaction was obtained on the original patient, twenty-three exposed persons were vaccinated in the following manner: A vesicle was first cleansed with a solution of boric acid and then with a saline solution, and the content removed by means of a small capillary tube. The exposed subjects were then vaccinated in a manner identical with the present day vaccination for smallpox. All vaccinations were performed on the second day after the original case appeared. Of the twenty-three persons who were vaccinated, six gave histories of having had varicella; one history was uncertain, and the remaining persons gave negative histories.

Of the twenty-three persons who were vaccinated, eight showed a successful reaction as evidenced by a papule, vesicle and crust at the site of vaccination. Five cases of frank varicella subsequently developed. Three more patients showed a rash so slight that it seemed perhaps proper to classify them as a "vaccinia." Three patients appeared to have been rendered immune as the result of vaccination. The results of the vaccinations are shown in the table.

The small number of persons who were vaccinated successfully may have been due, in several instances, to an insufficient amount of vaccine. It is probable that some of the subjects had had chickenpox at a previous date, although negative histories were obtained.

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* From the Pediatric Department, University, Va.

1. Greenthal, Roy M.: The Prophylaxis of Varicella with Vesicle Fluid, Am. J. Dis. Child. **31**:851 (June) 1926.

Since difficulty was experienced in obtaining positive reactions in a large percentage of cases, and since several patients developed varicella in spite of successful vaccination, I am doubtful if this method can be successfully employed as a means of preventing the disease in

Reactions to Varicella Vaccine

Case Number	History of Varicella	Take	Developed Varicella
Case 1	Yes	No	No
Case 2	No	No	Frank case
Case 3	No	No	Frank case
Case 4	No	No	Frank case
Case 5	No	No	No
Case 6	Yes	No	No
Case 7	Yes	Yes?	Mild case (vaccinia)
Case 8	No	No	No
Case 9	No	Yes	No
Case 10	No	Yes	Mild case
Case 11	Yes	Yes	No
Case 12	No	Yes	No
Case 13	No	Yes	Frank case (vaccinia)
Case 14	?	No	No
Case 15	No	No	No
Case 16	No	Yes	Mild case (vaccinia)
Case 17, nurse	No	No	No
Case 18, nurse	No	No	No
Case 19, nurse	No	No	No
Case 20, nurse	No	No	No
Case 21, nurse	Yes	No	No
Case 22, nurse	Yes	No	No
Case 23, nurse	No	Yes	Developed later at home

hospitals and in institutions for children. In several instances the disease appeared to be rendered more mild as the result of vaccination, and three patients appeared to have been rendered immune. I realize that this series of cases is too small to warrant definite conclusions.

DIENTAMOEBA FRAGILIS*

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In 1918, Jepps and Dobell[1] described the intestinal parasite, *Dientamoeba fragilis,* and suggested the name because of the morphology and characteristics. They give credit to Wenyon for first observing it in 1909, but the observation was not published. Since their paper appeared, about thirty-seven cases have been reported. Apparently most, if not all, of these occurred in adults.

Dientamoeba fragilis is described as a small ameba varying from 3.5 to 12 microns in diameter. According to Jepps and Dobell and to most of the other observers, it is normally binucleate in about 80 per cent of the individual organisms. Kudo,[2] in 1926, however, in studying the organism in a single case, found that approximately only 12 per cent were binucleated. When not moving, they appear in moist preparations as small, rounded, granular bodies. During locomotion they protrude leaflike, hyaline pseudopodia with irregular margins which gives rise to a slow zigzag movement. The hyaline ectoplasm of the pseudopodia is distinctly demarcated from the granular endoplasm of the organism itself.

In the unstained specimen and the usual iodine preparations, the nuclei are indistinct and difficult to make out. The ameba found in the three patients in this report are being studied by Dr. D. H. Wenrich of the School of Zoology, University of Pennsylvania, and a detailed description will appear in another report.

This paper will deal with the occurrence of the parasite in children and its association with a constant eosinophilia for which no other cause could be found.

REPORT OF CASES

CASE 1.—M. G., a girl aged 7 years and 3 months, gave a negative birth and family history. She was breast fed only two weeks. Artificial food did not agree with her, and she was poorly nourished throughout the first year. At 2 years of age, her tonsils and adenoids were removed because of recurring attacks of otitis media. She had pyelitis at 3 years and has had several minor recurrences. Varicella occurred in 1925, measles in 1926 and mumps in January, 1927. She had never had dysentery or severe attacks of diarrhea. The child has never been robust and has always had a poor appetite and a tendency to constipation.

* Received for publication, May 2, 1927.
* Read before the American Pediatric Society, Chesapeake Bay, May, 1927.
* From the Laboratory Service, Children's Hospital.

1. Jepps, Margaret W., and Dobell, C.: J. Parasitol. **10**:352, 1918.
2. Kudo, R.: Am. J. Trop. Med. **6**:299, 1927.

In November, 1925, she was brought to the office because of lack of energy, aggravated anorexia and a slight evening temperature ranging from 99 to 99.7 F. These symptoms had persisted for three or four weeks.

Examination.—Results of the examinations were essentially negative, except for the finding of malnutrition and fatigue posture. The abdomen was soft and not tender. The liver and spleen were not enlarged, but there was slight thickening in the region of the descending colon and sigmoid, a common occurrence in constipated children.

The results of the urinalysis were negative. The blood count showed: red blood cells, 5,390,000; white blood cells, 16,200; hemoglobin, 78 per cent (Sahli); neutrophils, 32 per cent; lymphocytes, 48 per cent; large mononuclears and transitionals, 2 per cent; eosinophils, 18 per cent.

The patient was given 0.1 mg. of old tuberculin intradermally, with negative results.

Examination of the stool showed numerous *Dientamoeba fragilis.* In order to verify the presence of the parasite, which was the first in our experience, another specimen was examined a few days later, with the same result. The second blood count showed 16 per cent of eosinophils.

Treatment and Course.—The patient was then given two courses of treatment. The eosinophils fell to 7 and 11 per cent and the number of *Dientamoeba* diminished markedly.

Blood Counts Made in Case 1

Date	Red Blood Cells	White Blood Cells	Hemoglobin Percentage	Neutrophils	Lymphocytes	Large Mononuclears and Transitionals	Eosinophils	Basophils
11/16/25	5,390,000	16,200	78	32	48	2	18	.
11/24/25	5,250,000	18,600	83	54	26	4	16	.
12/14/25	5,409,000	19,800	85	40	53	0	7	.
1/ 4/26	5,100,000	5,800	80	48	38	3	11	.
2/ 2/26	5,140,000	8,900	78	53	31	4	9	.
3/ 5/26	4,770,000	8,200	82	58	25	6	11	.
3/23/26	5,110,000	7,500	84	46	41	3	10	.
5/21/26	5,380,000	7,400	80	51	35	4	10	.
7/ 1/26	.....	19,000	..	57	28	4	10	1
5/ 6/27	4,900,000	8,900	86	54	35	4	7	.

Since that time (February, 1926) six blood counts showed from 7 to 11 per cent eosinophils, while the organisms were found only four times in sixteen examinations of the stools. At no time was the patient anemic.

At present her weight is 47 pounds 14 ounces (21.7 Kg.) for a height of 46½ inches (118.11 cm.). This is a normal weight for the height, the latter being the average for a child 6½ years old instead of 7¼ years, her present age. As the father, whom she resembles, is only 5 feet, 3 inches (160 cm.) tall, the deficiency is not noteworthy. She has been more healthy this winter than ever before, although her appetite is still relatively poor. The examination of the stool on May 6, 1927, showed a few *Dientamoeba.*

CASE 2.—C. K., a boy, aged 9½, gave a negative birth and family history. He was breast fed for two weeks. Artificial feeding was not successful, and he suffered from eczema and furunculosis during his first year. Except for occasional colds, he was well until July, 1923, when he developed hay-fever following exposure to the dust of a wheat-threshing machine. This was followed by bronchitis, which lasted until the winter. In March, 1924, he developed pertussis followed by mumps, and in May his tonsils and adenoids were removed. In October, he contracted a severe case of typhoid fever, presumably from eating water cress which grew in a polluted country brook, and this was followed by a definite psychosis, so that he was not able to return to school until March, 1925. In the summer of 1924, he was found to be sensitive to the proteins of timothy,

corn and the feathers of ducks. In the spring of 1925, he was desensitized and, by a repetition of this treatment each spring, he has remained practically free from hay-fever.

In February, 1926, nosebleed frequently occurred, and he fainted one morning. He was brought to the office on February 12. There were no specific complaints except that he tired easily, was unusually cross and was not keeping up in his school work.

Examination.—The results of the examination were essentially negative, except for malnutrition and fatigue posture. The weight was 60 pounds (27.2 Kg.), and the height was 52 inches (132.1 cm.).

A specimen of urine taken in the morning was negative, except for the presence of calcium oxalate crystals.

A blood count revealed: red blood cells, 4,200,000; white blood cells, 7,200; hemoglobin, 81 per cent (Sahli); neutrophils, 53 per cent; lymphocytes, 27 per cent; eosinophils, 14 per cent and basophils, 1 per cent. There was slight anisocytosis and the platelets numbered 290,000.

The patient was given 0.1 mg. of old tuberculin, intradermally with negative results.

Treatment and Course.—The eosinophils suggested an examination of the stool. *Dientamoeba fragilis* was found in large numbers. A course of treatment was given, and on February 22, the blood count showed more red cells and hemoglobin, only 4,900 white cells and 11 per cent eosinophils. Examination of the stool was negative. As the patient felt better, further study was not made until April 8, 1927, when a blood count still showed 10 per cent eosinophils, but the stool was negative for *Entamoeba.* This, of course, meant nothing—particularly in view of the fact that the family lived in the suburbs, and that it was difficult to secure a fresh stool. The child appeared to be perfectly well, although he was still underweight. His height was 53¾ inches (136.4 cm.) and his weight 65½ pounds (29.6 Kg.).

Case 3.—E. P., a girl, aged about 10, gave a negative birth and family history. She was breast fed for nine months. In her second year her tonsils and adenoids were removed because of frequent colds accompanied by otitis media. She was much benefited. In 1920, she had chickenpox, pertussis in 1921, measles in 1922 and mumps in 1924. In the summer of 1925, she had dysentery, which lasted for eight weeks, but from which she apparently made a good recovery.

In August, 1926, she suffered from intestinal indigestion with much flatulence, which was relieved by a readjustment of her diet. In October, however, she was found to be losing weight, running an evening temperature up to from 99.7 to 100 F., occasionally to 101 F., and was constantly tired. After a few weeks of modified rest cure, she regained some weight but still lacked energy, although the temperature rarely exceeded 99.6 F. The condition was ascribed to too rapid growth. Early in January, 1927, she developed "grip" of moderate severity. Following this, a slight cough persisted, and the temperature ranged from 99.4 F. in the morning, down at noon, to an afternoon rise of from 99.4 to 100 F. On Jan. 25, 1927, the child was brought to the office. She weighed 60 pounds (27.2 Kg.), and was 52¾ inches (133.9 cm.) in height.

Examination.—She was tired looking, pale and poorly nourished, with dry cracked lips and slight enlargement of the anterior cervical nodes. The lung expansion was poor, and a few dry coarse râles were heard at the bifurcation of the bronchi. There was fatigue posture, and the abdominal tension was increased, although there was no tenderness, masses or enlargement of the liver or spleen. The finger-nails showed moderate transverse and longitudinal curvature; otherwise the examination was essentially negative.

Examination of specimens of urine taken in the morning and afternoon was negative.

The blood count revealed: red blood cells, 3,800,000; white blood cells, 11,500; hemoglobin, 78 per cent (Sahli); neutrophils, 49 per cent; lymphocytes, 41 per cent; large mononuclears and transitionals, 4 per cent; eosinophils, 6 per cent.

Examination of the first stool specimen was negative, except for a slight excess of the gas bacillus.

A roentgenogram of the chest was negative, except for prominent trunk shadows. Old tuberculin, 0.1 mg., was administered intradermally, with negative results. The slight excess of eosinophils suggested another examination of the stool, and this showed large numbers of *Dientamoeba fragilis.*

Course of Illness.—The patient was sent home to her physician for treatment. A brief note from him, just received, states that *Dientamoeba* cannot be found in the stool, but that she still has eosinophilia and a slight rise in evening temperature up to 99.4 F. He makes no statement as to her nutrition or general condition.

That the presence of the organism had anything to do with the ill health of these children is problematic. Two of the children lived under excellent hygienic conditions, one gave a history of dysentery, one was chronically constipated, but none had any abdominal symptoms or was subject to the attacks of diarrhea that have been described as occurring in infestation with *Endamoeba histolytica.*[3]

All of the children were of the asthenic malnourished type seen so frequently in pediatricians' offices. Whether infestation with *Dientamoeba fragilis* must be added to the possible causes for malnutrition remains to be determined.

The treatment we employed was as follows: Emetin-bismuth-iodide, 0.06 to 0.2 Gm. in keratin coated capsules by mouth three times a day for four days. This was followed by an enema of a proprietary containing iodo-oxyquinoline sulphonic acids. From 200 to 300 cc. of a 1.5 to 3 per cent solution was used each evening for six days, preceded by a cleansing enema. This product can also be used by mouth in pills, 4 Gm. each.

It is noteworthy that it is difficult to eliminate the parasite completely. Two of the children improved with partial elimination, but a complete cure apparently can be obtained only by persistence in a treatment which is somewhat difficult to administer to a child. In fact, it was objected to so much that, with the improvement following the first effects, the parents were satisfied to stop treatment so long as we could not assure them of the pathogenicity of the organism.

Certain facts with regard to the examination of stools for *Dientamoeba fragilis* deserve emphasis.

1. The organism is found much more frequently in a soft stool, either produced by catharsis or from a spontaneous diarrhea, then in a hard formed stool.

2. *Dientamoeba fragilis* begins to degenerate almost immediately after the stool is passed, first showing a small vacuole, which becomes larger until it leaves only a ring of protoplasm around the vacuole. In

3. Craig, C. F.: The Symptomatology of Infection with Endameba Histolytica in Carriers, J. A. M. A. **88**:19 (Jan. 1) 1927.

this stage it may easily be confused with *Blastocystis hominis*. In from one to two hours all of the organisms usually are beyond recognition. For example, Jepps and Dobell found it only nineteen times in forty-two examinations of one patient and only once in seven examinations of another. In one of our patients it was found once in two examinations, in another once in three, and in the third, seven times in nineteen examinations.

3. Because of the absence of cyst formation, the diagnosis depends on finding the rapidly degenerating vegetative form. Although Kofoid [4] in 1923 described cysts for this organism, other investigators have been unable to identify them.

SUMMARY

Infestation with *Dientamoeba fragilis* in three children is reported. All of the children were asthenic and slightly malnourished. Two of them are known to have improved following treatment, with a diminution in the number of parasites, but it is problematic whether there was any connection between this infestation and the symptomatology. It seems possible that it may be one cause for malnutrition and asthenia. The occurrence of unexplained eosinophilia should suggest an examination of the stools. The specimens must be as fresh as possible, as the organism will degenerate so as to become unrecognizable in from one to two hours after the stool is passed.

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4. Kofoid, G. A.: Univ. California Chronicle **25**:174, 1923.

PULMONARY TUBERCULOSIS IN INFANTS

BACTERIOLOGIC DIAGNOSIS BY EXAMINATION OF THE STOMACH CONTENTS *

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Many pediatricians and phthisiologists regard the diagnosis of pulmonary tuberculosis in infancy and in childhood as impossible or at least difficult. The reasons are that the child does not expectorate and that physicians do not find the examination of the stool, the pharyngeal mucus or the gastric content useful.

About thirty years ago, Dr. H. Meunier [1] of Pau, France, showed that it is possible to obtain the sputum of an infant if one lavages the stomach early in the morning, just after the first cough and before the first meal. Under such conditions, it is easy to examine the material by the Ziehl method. Unfortunately, thus far few investigators have tried this method. I have been using it for many years, often with success. About a year ago, my assistant, Dr. Vibert, perfected the method by means of homogenization, making the finding of the tubercle bacilli much easier. Dr. Vibert and I [2] have recently published the results which we obtained with this method and which I think should be brought to the attention of pediatricians.

In the first place, the method does not present any difficulty. During the past year it has been employed successfully in 174 cases. The technic is as follows: About 80 cc. of tepid water is introduced into the stomach and withdrawn by siphoning. This is accomplished by means of a stomach tube which has been lubricated with albolene or olive oil, and which has a tube or funnel attachment. In some cases in which real cavities are found in the lung, purulent sputum is obtained, while in other cases in which bacteriologic examination is particularly important only a few flecks of mucus are seen.

If characteristic sputum is obtained, direct microscopic examination by the Ziehl-Neelsen method is all that is necessary, but in most cases homogenization is required. The liquid is centrifugalized in four tubes and the precipitates united in a porcelain dish to which is added 30 cc. of water and 10 drops of normal sodium hydroxide; the whole is heated for ten minutes, 50 cc. of water being added slowly. If the specific

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* Received for publication, June 2, 1927.
* From the Pediatric Service of Hôpital Herold, Paris.
* Read by title before American Pediatric Society, May 14, 1927.

1. Meunier, H.: Presse méd., Aug. 13, 1898.

2. Armand-Delille, P. F., and Vibert, J.: Presse méd. **35**:402, 1927; read before the Académie de Médécine de Paris.

gravity is over 1.004, a little alcohol is added. The material is again placed in four tubes and centrifugalized for forty-five minutes, and the precipitate is stained by the Ziehl-Neelsen method. The stomach contents can be kept two or three days before homogenization without destroying the tubercle bacilli. Microscopic examination must be carefully made, because in some cases it is rather difficult to find the bacilli.

The results obtained by this method have been interesting. In sixty-two cases in which only the direct examination without homogenization was used, tubercle bacilli were found in only 10 per cent, while in 110 cases in which the method here detailed was employed 31 per cent were positive.

This difference is important because the examinations were made not only of those patients in whom the physical and roentgen-ray observations were positive, but also in many cases in which the child presented only more or less bronchitis and a little fever, and had been in contact with tuberculous parents. In two patients in whom the only characteristics were small hilus shadows and who had been in contact with tuberculous parents, tubercle bacilli were found in the stomach contents. To me this method seems easier and safer than the examination of material coughed up onto a cotton swab in the pharynx, which gives positive results only when large areas of caseation are present. It is much easier than bacteriologic examination of the feces, which takes more time and in which the tubercle bacilli may come from the gallbladder or intestine.

CONCLUSION

In my experience this simple and easy method is the only means (together with roentgen-ray examination) of confirming the tuberculous nature of some lung conditions in infants—an important circumstance in the prognosis and treatment, if one wishes to use artificial pneumothorax.

NONDIABETIC KETOSIS IN CHILDREN *

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Despite the frequency and clinical importance of nondiabetic ketosis in childhood, there have been relatively few investigations concerning its mechanism. Recently, the knowledge of ketosis has been considerably extended, due largely to investigations on normal and diabetic subjects. That the interrelationship between the metabolism of fat and carbohydrate plays the major rôle in the mechanism of ketosis has long been known, but the subject has been considerably clarified by the more recent work of Woodyatt, Shaffer, Ladd and Palmer and others.

It now seems reasonably well established that diet operates in proportion to the quantities of fatty acids and glucose made available to the metabolic mixture, and that excess of a definite fatty acid to glucose ratio tends to result in ketosis. Although subject to some variation, it seems probable that in adults the threshold of ketosis is represented by an approximate ratio of fatty acid 1.5 to glucose 1, according to the method of calculation used by Woodyatt.[1]

Our investigation was undertaken in the effort to determine the influence of diets containing different fatty acid-glucose ratios and of fasting on the occurrence of ketosis in children and to obtain any evidence that might serve to explain the increased susceptibility of certain children to ketosis.

TECHNIC

1. *Diets.*—The various methods of calculating the fatty acid-glucose ratios of diets correspond sufficiently to permit the use of a single standard. The procedure advocated by Woodyatt [1] was used in this study. His formula [2] for the evaluation of the opposing food factors is, briefly:

$$\frac{F.\ A.}{G.} = \frac{(0.9\,F + 0.46\,P)}{(0.1\,F + 0.58\,P + C)}$$

The fore-period diets yielded fatty acid-glucose ratios of 1:3 and were raised at intervals of from two to four days by increasing fat at the expense of carbohydrate through the ratios 1, 1.5, 2 and 3. The ratios were calculated from foods actually ingested during each period. The protein and caloric intake were kept

* Received for publication, April 19, 1927.

* From the Department of Pediatrics, Cornell University Medical College, and the New York Nursery and Child's Hospital.

1. Woodyatt, R. T.: Objects and Methods of Diet Adjustment in Diabetes, Arch. Int. Med. **28**:125 (Aug.) 1921.

2. The figure for the ketogenic value of protein is not definitely established. *F*, fat; *C*, carbohydrate; *P*, protein.

uniform throughout and were adequate to cover the maintenance requirements as computed from the figures of Benedict and Talbot.[3] The diets yielded an average of 60 calories per kilogram per twenty-four hours.

The foodstuffs came from a common source and were prepared by the same dietitian. Uniformity and simplicity were secured by prescribing wheat bread, cooked cereals, cream, milk, lean beef and simple vegetables. The importance of fluctuations in the composition of many foods has been shown by Ladd and Palmer.[4] The foods mentioned seemed least open to objection on this score. Individual analyses of all foods were not made.

During the fasting periods, the patients received only 35 ounces (1,035 cc.) of water daily.

2. *Fluids.*—The twenty-four hourly intake was 35 ounces throughout all periods. This figure was arrived at by averaging the voluntary intake of convalescent children of the age and weight of our subjects. The necessity for maintaining a constant fluid intake became apparent early in our studies, when it was observed that a high fluid intake caused early and irregular excretion of urinary organic acids.

3. *Exercise.*—The children were allowed to sit in the ward go-carts for a few hours every day, but neither violent exercise nor active play was permitted at any time.

4. *Urine.*—The total twenty-four hour specimens of urine were examined each day for p_H (Henderson and Palmer),[5] ammonia (Folin and Macallum),[6] titratable acidity (Henderson),[7] organic acids (Van Slyke and Palmer),[8] acetone bodies (Van Slyke)[9] and creatinine (Folin).[10] Urinary nitrogen (Kjeldahl) was estimated for each individual period. The values for urinary acids and bases were expressed in terms of tenth normal acid and base per kilogram per twenty-four hours.[11]

A number of these estimations had a bearing on the presence, degree and effect of ketosis. It was found, however, that a consideration of the excretion of organic acids and acetone substances in the urine served as a satisfactory index. In general, they paralleled closely the p_H, ammonia and titratable acidity of the urine as well as the blood p_H, plasma bicarbonate and blood acetone. For purposes of clarity, they have been used as representative. The correlation between these values is shown in table 2.

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3. Benedict, F. G.: Energy Requirements of Children from Birth to Puberty, Boston M. & S. J. **181**:107 (July) 1919. Benedict, F. G., and Talbot, F. B.: Metabolism and Growth from Birth to Puberty, Carnegie Institute of Washington, Publication no. 302, 1921.

4. Ladd, W. S., and Palmer, W. W.: The Use of Fat in Diabetes Mellitus and the Carbohydrate-Fat Ratio, Am. J. M. Sc. **166**:157 (Aug.) 1923.

5. Henderson, L. J., and Palmer, W. W.: On the Intensity of Urinary Acidity in Normal and Pathological Conditions, J. Biol. Chem. **13**:393, 1913.

6. Folin, O., and Macallum, A. B.: On the Determination of Ammonia in Urine, J. Biol. Chem. **11**:523, 1912.

7. Henderson, L. J.: A Critical Study of the Process of Acid Excretion, J. Biol. Chem. **9**:403, 1911.

8. Van Slyke, D. D., and Palmer, W. W.: Studies of Acidosis: XVI. Titration of Organic Acid in Urine, J. Biol. Chem. **41**:567 (April) 1920.

9. Van Slyke, D. D.: Studies of Acidosis: VII. The Determination of Beta-Hydroxybutyric Acid, Aceto-Acetic Acid and Acetone in Urine, J. Biol. Chem. **32**:455, 1917.

10. Folin, O.: On the Determination of Creatinine and Creatine in Urine, J. Biol. Chem. **17**:469, 1914.

11. Chlorides and phosphates were measured, but failed to yield helpful information in the four cases studied.

TABLE 1.—*Summary of Clinical Histories*

Name	Age (Years)	Sex*	Weight (Kilograms)	History	Course in Hospital †
E. G.	10	♂	22	Normal child.....	Temperature normal; no clinical evidence of ketosis with diets; weight stationary
E. F.	9	♂	20.4	Normal child.....	Temperature normal; no clinical evidence of ketosis with diets; weight stationary
E. B.	6	♂	20	Normal child.....	Temperature normal; no clinical evidence of ketosis with high-fat diets; weight stationary
F. S.	6	♂	16	Attacks of ketosis accompanying upper respiratory infection	No fever; drowsy with high-fat diets; weight stationary
M. G.	8	♂	18	Attacks of ketosis accompanying upper respiratory infection; previously observed during an attack; migratory joint pains; enlarged and diseased tonsils	No fever; drowsy with high-fat diets; weight stationary
S. S.	9	♂	17.2	Attacks of ketosis accompanying follicular tonsillitis; definitely diseased and enlarged tonsils; migratory joint pains, low grade fever during attacks	No fever; drowsy with high-fat diets; poor cooperation, diets refused; weight loss
R. W.	7	♂	20.1	Attacks of ketosis accompanying follicular tonsillitis; previously observed during an attack; at operation, free pus found in both tonsillar fossae	No fever; drowsy with high-fat diets; weight stationary
H. Q.	11	♂	24	Severe ketosis during recurrent vomiting attacks; tonsils previously removed; several apical abscesses of teeth present; their removal precipitated severe ketosis	No fever; drowsy with high-fat diets; weight stationary
H. F.	6	♂	16.3	Severe attacks of ketosis accompanying upper respiratory infections; tonsils previously removed; migratory joint pains	No fever; severe ketosis during high-fat diets and fasting
A. T.	5	♂	14.6	Recurrent attacks of ketosis with vomiting; observed during one of these attacks; recurrent follicular tonsillitis	No fever; drowsy, hyperpnoic, pharynx injected while on high-fat diet; study discontinued

* In this column, ♂ indicates male.

† Wassermann and tuberculin reactions were negative in all the patients except for a positive Pirquet reaction in H. Q. and E. F. In these two patients, roentgenograms of the chest were normal.

Examination of the urine for albumin, sugar and microscopic changes was made for each period in all cases. The results were invariably negative.

5. *Blood.*—Blood sugar (Folin and Wu),[12] blood p_H (Cullen,[13] blood acetone bodies (Van Slyke and Fitz) [14] and plasma carbon dioxide content (Van Slyke and Stadie) [15] were measured when indicated.

TABLE 2.—*The Acid-Base Balance of Urine and Blood on Different Dietary Fatty Acid-Glucose Ratios*

	Urine				Blood		
F. A.: G. Ratio of Diet	Organic Acid (Cubic Centimeter of Tenth Normal Per Kilogram)	Total Acetone Bodies as Acetone (Cubic Centimeter of Tenth Normal Per Kilogram)	Base-Saving (Cubic Centimeter of Tenth Normal Per Kilogram)	p_H	CO_2 Vol., Per Cent	p_H	Total Acetone Bodies as Acetone (Grams Per Hundred Cubic Centimeters)
			E. G. (Normal Child)				
1:2	11.2	0	20.1	5.6	—	—	—
1:1	13.6	0	26.1	5.1	—	—	—
2:1	14.5	0	26.0	5.0	64.5	—	.004
3:1	20.6	9.1	30.1	5.3	67.3	....	—
			E. F. (Normal Child)				
1:2	13.1	0	....	6.2	55	7.34	
1:1	15.4	0	....	6.0	54.1	7.32	
1.5:1	18.4	0	....	5.6	43.0	7.29	
2:1	19.1	3.0	....	6.4	44.4	7.28	
2.5:1	20.9	3.67	....	5.4	44.1	7.25	
3:1	23.8	6.37	....	5.7	43.8	7.28	
			E. B. (Normal Child)				
1:2	11.3	0	....	6.8			
1:1.5	13.0	0	....	5.7			
1.5:1	15.1	14.0	....	5.8	41.4	7.25	—
2:1	25.0	21.4	....	6.1	41.0	7.21	—
2.5:1	30.0	7.9	....	5.9	35.0	—	—
3:1	22.5	5.3	....	5.8	52.2	7.25	
			F. S. (Susceptible Child)				
1:3	8.6	0	25.3	5.4	—	—	—
1:1	21.5	0	24.9	5.2			
2:1	29.5	12.4	23.4	5.0			
3:1	67.6	60.5	28.9	5.0	....	....	.017
			M. G. (Susceptible Child)				
1:3	12.7	0	20.1	5.2	78.2		
1:1	10.2	0	31.9	5.0	—		
2:1	32.4	9.4	41.6	5.0	—		
3:1	75.8	50.1	47.2	5.0	51.9		
			S. S. (Susceptible Child)				
1:1	9.0	0	10.2	5.7			
1.5:1	25.4	3.8	34.3	5.8			
2:1	34.1	5.4	28.9	5.2			
3:1	37.1	26.9	28.0	5.2			
			R. W. (Susceptible Child)				
1:3	9.5	0	20.0	5.4			
1:1	21.5	0.8	25.5	5.4			
2:1	34.5	23.1	50.3	5.0			
3:1	56.3	46.4	45.6	5.0			

12. Folin, O., and Wu, H.: A System of Blood Analysis. Supplement I. A Simplified and Improved Method for Determination of Sugar, J. Biol. Chem. **41**:367 (March) 1920. Rothberg, V. E., and Evans, F. A.: A Modified Folin and Wu Blood Sugar Method, J. Biol. Chem. **58**:443 (Dec.) 1923.

13. Cullen, G. E.: Studies of Acidosis: XIX. The Colorimetric Determination of the Hydrogen Ion Concentration of Blood plasma, J. Biol. Chem. **52**:501, 1922.

14. Van Slyke, D. D., and Fitz, R.: Studies of Acidosis: VIII. The Determination of Beta-Hydroxybutyric Acid, Aceto-Acetic Acid, and the Acetone in Blood, J. Biol. Chem. **32**:495, 1917.

15. Van Slyke, D. D., and Stadie, W. C.: The Determination of the Gases of the Blood, J. Biol. Chem. **49**:1 (Nov.) 1921.

6. *Feces.*—Daily quantitative estimations of the stool fat (Sperry and Bloor) [16] were made on patients E. F., S. G. and E. S.

7. *Subjects.*—The children studied were of two clinical groups: first, three normal children and second, seven children subject to attacks of ketosis. The essential features of their histories are shown in table 1.

THE EFFECT OF DIETS WITH DIFFERENT FATTY ACID-GLUCOSE RATIOS ON NORMAL CHILDREN AND ON CHILDREN SUBJECT TO ATTACKS OF KETOSIS

While on high carbohydrate and low fat diets (F.A.1 : G.3) all of the children, both the normal and those subject to attacks of ketosis, excreted approximately 10 cc. of tenth normal organic acid per kilogram of body weight each day. With progressive increase in the fat content of the diets, normal children reacted differently from those especially subject to ketosis, as they showed a relatively small increase in the excretion of organic acid in contrast to sharp increases shown by children subject to attacks of ketosis. For example, on a ratio of F.A.3 : G.1, the greatest output of organic acid by any of the normal children was 25 cc. of tenth normal acid per kilogram of body weight, whereas the figures for organic acid were much higher in children subject to ketosis, reaching a maximum output of 76 cc. of tenth normal acid per kilogram in subject M. G. while on a similar diet. The average daily organic acid excretion by the four susceptible children [17] on diet F.A.3 : G.1 was 55 cc. of tenth normal acid per kilogram, while that of the normal children was 23 cc. of tenth normal acid per kilogram (fig. 1).

The behavior with regard to urinary acetone excretion was similar. Indeed, acetone was not found in the urine of any of the children by the delicate sodium nitroprusside test, until diets with ratios of 1 : 5 were reached. Quantitative determinations of the excretion of acetone substances were made on two normal children and on two children susceptible to ketosis while on the dietary ratios described in the foregoing. One normal child did not show any acetone in the urine by quantitative test; the other showed an average daily excretion of 12 cc. of tenth normal acetone per kilogram of body weight, while the daily excretion by the susceptible children was 5 and 15 cc. of tenth normal acetone per kilogram, respectively. With the next increase to F.A.2 : G.1, all of the children excreted measurable amounts of acetone substances in the urine. However, the average excretion by susceptible children

16. Sperry, W. M., and Bloor, W. R.: Fat Excretion: II. The Quantitative Relations of the Fecal Lipoids, J. Biol. Chem. **60**:261, 1924.

17. The term susceptible children is used to designate those who had developed severe ketosis under conditions which are without effect on normal children. This difference is obviously merely one of degree, for practically all persons will develop measurable degrees of ketosis when conditions are favorable.

(14 cc. per kilogram) was more than twice that of the normal children (6 cc. per kilogram). The highest ratio, F.A.3:G.1, further differentiated the normal from the susceptible children. Those susceptible to ketosis excreted daily an average of 45 cc. of tenth normal acetone per kilogram, while the average excretion by normal children was only 6.3 cc. per kilogram.

Of special interest are the children F. S. and M. G., who excreted the largest amounts of acetone (60 cc. of tenth normal and 50 cc. of

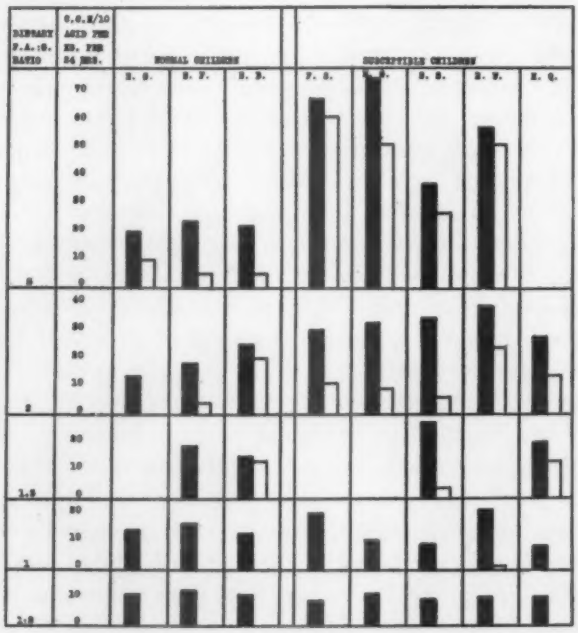

Chart 1.—Excretion of organic acid (solid columns) and acetone (blank columns) in urine by normal and susceptible children while on diets of different fatty acid-glucose ratios.

tenth normal per kilogram, respectively). Their histories showed the recent occurrence of subacute infections[18] accompanied by severe

18. There is no question that acute infections play a definite but obscure rôle in causing ketosis in some children. The evidence for this statement rests on the frequent association of infections of the upper respiratory tract and severe ketosis in certain children and the beneficial effect of the removal of foci of infection. This was emphasized first by Sedgwick and Taylor[19] and later by one of us (O. M. S.).[20] Just how such infections act and why they precipitate attacks of ketosis in some persons only is entirely unknown.

19. Taylor, R.: Relationship between Tonsillar Infection and Recurrent Vomiting, Minnesota Med. **2**:61 (Feb.) 1919.

20. Schloss, O. M.: Acetone Body Acidosis in Children, Clin. N. Amer. **2**:1 (July) 1918.

ketosis. This was true to a somewhat lesser degree of all of the susceptible children. Further, F. S. suffered recurrent attacks of vomiting with ketosis and had subacute infectious foci. It is of interest to note that, despite the relatively high acetone excretion, none of these children showed severe clinical symptoms. Indeed, drowsiness, irritability and a definite acetone breath occurred in only three cases, M. G., R. W. and H. Q., while on the highest ratio (F.A.3:G.1). At this time, the plasma bicarbonate content of H. Q. and of R. W. was 51.9 and 35.3 per cent by volume, respectively. Two children, A. T. and H. F., who showed clinical symptoms of acidosis while on high fat diets, had demonstrable acute infections which must be taken into account (fig. 5).

Comment.—These observations show that when on diets disproportionately high in fat, children who have been subject to recurrent attacks of ketosis excrete vastly larger amounts of organic acid and acetone than normal children. These experimental results are thus in close accord with actual clinical experience and are probably dependent on the same metabolic perversion that causes the development by some children of significant degrees of ketosis from infections or other agencies incapable of producing the same effect in persons who are strictly normal. The cause of this difference is probably of fundamental importance. Evidence bearing on this problem is to be presented later, but it will perhaps serve the purpose of clarity to discuss the subject briefly at the present time.

Our calculations of ketogenic-antiketogenic ratios were based on food ingested and not on food actually metabolized. This introduces a source of error, since obviously the regulation of ketogenesis is dependent on the actual combustion of metabolites and not on the composition of the diet. Ingested food may escape absorption from the bowel and may thus have no influence on actual metabolism. Also, food though absorbed may be stored and not burnt when ingested, thus being without immediate influence. It is also possible that part of the metabolic mixture at a given time may be derived from food previously stored and therefore may not enter into calculations based solely on food ingested.

In our investigations, however, both groups of patients were fed identical diets so that any error from such a source might be expected to operate equally in both groups. If this were not the case, the unequal operation of some of the processes cited might prove to be of significance in influencing the susceptibility of some persons to ketosis. It seems improbable that the greater production of ketone substances by the group of susceptible children could be explained on the basis of variation of food absorption. An attempt to do this would involve the rather far-fetched assumption that fat was more completely or carbohydrate less completely absorbed by the susceptible children

than by the normal ones. This possibility in regard to fat, at least, has been reasonably excluded by direct determinations of fat absorption on three patients, E. F., S. G. and E. S., which did not demonstrate any departure from the normal (table 4). For obvious reasons no determination of the absorption of carbohydrate was attempted.

If we assume that ingested food is absorbed to the same extent by both groups of children, the question arises whether abnormal susceptibility to ketosis may not be due to a threshold of ketosis represented by a lower ketogenic-antiketogenic ratio than normal. In this event an amount of glucose sufficient to insure complete combustion of a given amount of fat in a normal child might prove inadequate in the case of one especially predisposed to ketosis. A satisfactory answer to this question would require measurement of the actual metabolism by means of respiratory quotients which we did not make on our patients. We have, however, the data of Wilson, Levine and Rivkin.[21] They found the threshold of ketosis significantly lower in all children than in adults, but their observations on N. H., who was subject to "cyclic vomiting," did not disclose a lower threshold than that of the normal children. This possibility cannot be dismissed completely on the basis of observations of a single patient but can be determined positively only after other investigations.

Probably the view that has been most discussed in explanation of the susceptibility of some children to ketosis concerns a possible deficiency of storage of glycogen. Direct evidence for this opinion is lacking, but the indirect evidence of low blood sugar found at times in ketosis and the curative effect of glucose has been cited by several observers in its favor. Our data bearing on the storage of glycogen will be presented in another section of this paper, and further discussion will be deferred until these results are cited.

THE EFFECT OF A FORTY-EIGHT HOUR FAST ON KETOSIS INDUCED BY HIGH-FAT DIETS

The observations in the foregoing section represented the degree of ketosis induced by high-fat diets in normal children and in children subject to ketosis. The opportunity was thereby afforded to observe the effect of a forty-eight hour fast on the ketosis of such origin in three children of the susceptible group. These children had ingested diets with progressively increasing fatty acid-glucose ratios for several days, reaching a ratio of 3 immediately preceding the onset of the fasting period (fig. 2).

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21. Wilson, J. R.; Levine, S. Z., and Rivkin, Helen: The Respiratory Metabolism in Infancy and Childhood: II. Ketosis and Respiratory Exchange in Children, Am. J. Dis. Child. **31**:335 (March) 1926.

On the high-fat diets, two of the children (M. G. and R.W.) had marked ketosis as represented by an organic acid excretion of 78 and 55 cc. of tenth normal acid per kilogram, respectively. The excretion of organic acid in the third child (S. S.) was moderate only (38 cc. of tenth normal acid per kilogram) presumably because she had refused food to the point of virtual starvation. However, the food she ingested was of the ratio F.A.3 : G.1. The first two children (M. G. and R. W.) excreted less organic acid and acetone after a forty-eight hour fast. The reduction was from 78 and 55 cc. to 45 and 35 cc., respectively, of tenth normal organic acid per kilogram. The excretion of organic acid in the third child (S. S.) did not change significantly, probably because the actual fast differed little from her previous consistent refusal of the bulk of her diet.

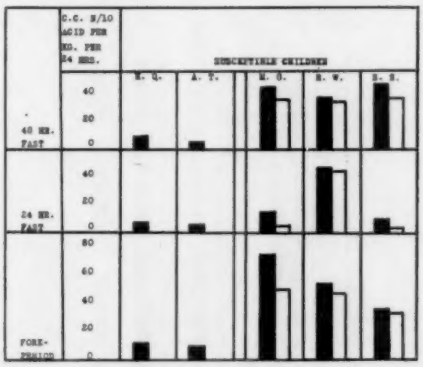

Chart 2.—Excretion of organic acid (solid columns) and acetone (blank columns) in urine by susceptible children during a forty-eight hour fast subsequent to diets yielding fatty acid-glucose ratios of 1 : 3 and 3 : 1, respectively. The fore-period diets of patients H. Q. and A. T. yielded the former ratios; the fore-period diets of the other subjects M. G., R. W. and S. S. yielded the latter ratios.

The effect of ketogenic diets and subsequent fasting on the blood sugar of these children is shown in figure 3. The blood sugar of M. G. was reduced slightly by the high-fat diet preceding the fast and showed a further reduction from 62 to 48 mg. after the fast of forty-eight hours; that of R. W., which was diminished by the ketogenic diet, showed a slight increase following the fast, but this increase was hardly of sufficient degree to be significant. The lowest blood sugar was found in S. S. It was 35 mg. after the ketogenic diet and showed an insignificant further diminution after the fast.[22] Two other patients

22. The observations on this patient are not strictly comparable to those in the others, owing to the fact that she had ingested little food for some days. Also, but of less importance, she had ingested a diet much lower in fat which yielded a ratio of 1.5 immediately preceding the blood sugar determination.

(E. G. and F. S.), who were studied in a similar fashion, showed blood sugar values of 72 and 68 mg. per hundred cubic centimeters, respectively, following the high-fat diets and 42 and 35 mg., respectively, at the end of the forty-eight hour fast.

These low blood sugar values seemed to us of special interest in view of the absence of toxic symptoms. Symptoms similar to those which accompany insulin hypoglycemia were not observed, and this offers confirmatory evidence that such disturbances cannot be due to the low blood sugar alone. There were no toxic symptoms similar to those often observed in severe ketosis, which have been considered by Hilliger,[23] Ross and Josephs,[24] Josephs [25] and others to be closely

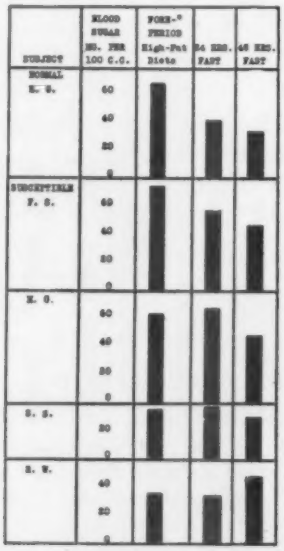

Chart 3.—Blood sugar of one normal (E. G.) and four susceptible children at the end of twenty-four and forty-eight hours of fasting subsequent to ingestion of high-fat diets for approximately twelve days (F. A. : G ratio of 3). In the case of S. S., the F. A. : G. ratio of the fore-period diet was 1.5.

related to the low blood sugar. It seems hardly possible that the failure of these children to develop severe ketosis during the fast could be due to the adequacy of reserve glycogen. The low blood sugar and the fact that they had diets of increasing ketogenic action over a long period, which would serve to drain the stores of glycogen, seem to render such an assumption unlikely. It seems also of interest that the

23. Hillger: Ueber periodisches Erbrechen mit Acetonämie, Jahrb. f. Kinderh. **80**:1, 1914.

24. Ross, S. G., and Josephs, H. W.: Observations of the Metabolism of Recurrent Vomiting, Am. J. Dis. Child. **28**:447 (Oct.) 1924.

25. Josephs, H.: Recurrent Vomiting, Am. J. Dis. Child. **31**:657 (May) 1926.

blood sugar of E. G., a normal child, reached the extremely low value of 32 mg. at the end of forty-eight hours, which was lower than that of any of the susceptible children with the exception of S. S.

We have no adequate explanation for the striking reduction by fasting of the ketosis induced by high-fat diets but can only offer suggestions based on the perhaps analogous reduction of ketosis in diabetes under similar circumstances: 1. No further fat is ingested and, in consequence, any glucose available is able to insure the more complete combustion of ketogenic fatty acid. 2. The fat drawn from endogenous sources is comparatively small, owing to the sharp reduction of metabolism due to fasting. 3. Body protein serves as a source of glucose, which is effective in the presence of the smaller amount of fat actually metabolized.

The effect of starvation in reducing nondiabetic ketosis is in accord with the clinical history of cyclic vomiting before glucose was employed

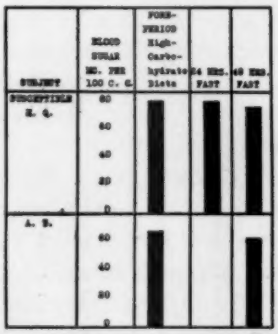

Chart 4.—Blood sugar of two susceptible children after forty-eight hours of fasting subsequent to three-day periods of high-carbohydrate intake (F. A. 1: G. 3).

in its treatment. Spontaneous recovery practically always occurred following a period of starvation due to persistent vomiting.

THE EFFECT OF A FORTY-EIGHT HOUR FAST ON CHILDREN SUSCEPTIBLE TO KETOSIS SUBSEQUENT TO HIGH CARBOHYDRATE DIETS

These observations represent a more direct test of the storage of glycogen than the preceding ones. It is known that under ordinary conditions fasting may cause a temporary but considerable degree of ketosis, usually appearing during forty-eight hours' abstinence from food. It would seem, therefore, that if the susceptibility of some children to severe ketosis were dependent on defective storage of glycogen, marked ketosis would be evident during fasting. That such may be true is suggested by the observations of Hilliger,[23] Ross and Josephs [24] and others.

Two of our patients, H. Q. and A. T., of known susceptibility to severe ketosis, had received a diet of F.A.1 : G.3 for three days preceding a forty-eight hour fast. During the fast, neither patient developed ketosis (fig. 2). Indeed, there was no increase in excretions of organic acids, no reduction of blood sugar and a negative test for acetone in the urine.

These observations, therefore, show definitely that patients subject to ketosis may be capable of storing glycogen adequate to insure the complete combustion of fat during a fast. This seems especially significant, in view of the considerable degree of ketosis that develops in a large percentage of normal children under similar conditions. The observations of Levine, Wilson and Rivkin [26] on N. H. (case 5) furnish even more direct evidence. They found by determining the respiratory quotients that this patient, who was subject to cyclic vomiting, stored glycogen as efficiently as normal children.

We do not feel that these observations prove conclusively that ketosis may not arise in some instances from insufficient storage of glycogen. They do show definitely that children subject to ketosis may store glycogen in a normal way, but they do not demonstrate that this applies to all cases at all times. It is possible that the cause of susceptibility to severe ketosis is not constant or uniform and that in some cases defective storage of glycogen may play a definite rôle. It is conceivable also that under certain conditions children susceptible to ketosis may suffer a temporary impairment of glycogenesis and at such times ketosis occurs. Although conceivable, there is no evidence to indicate the occurrence of such temporary impairment of the storage of glycogen and, therefore, such a hypothesis cannot be discussed to any advantage in the absence of relative data. We do feel, however, that our observations warrant the opinion that defective storage of glycogen is not the fundamental perversion of metabolism on which susceptibility to ketosis depends.

THE RELIEF OF KETOSIS BY HIGH CARBOHYDRATE INTAKE

It is well known that ketosis is usually relieved by the proper administration of carbohydrate. We had the opportunity to observe the effect of carbohydrate on ketosis of three types: (1) ketosis following a forty-eight hour fast; (2) ketosis produced by high-fat diets, and (3) ketosis of spontaneous origin. The organic acid and the excretion of acetone were again used to represent the reactions of these children.

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26. Levine, S. Z.; Wilson, J. R., and Rivkin, Helen: The Respiratory Metabolism in Infancy and Childhood: III. Glycogen Storage in Children, Am. J. Dis. Child. **31**:496 (April) 1926.

1. Four children who had fasted for forty-eight hours showed ketosis of varying degrees (fig. 5 *A*).

The fast terminated by the ingestion of a high carbohydrate diet with a ratio of F.A.1 : G.3. After twenty-four hours, there was a definite fall in acetone of urinary acid excretion in every instance. This reduction continued, so that at the end of forty-eight hours there was a return to average fore-period values.

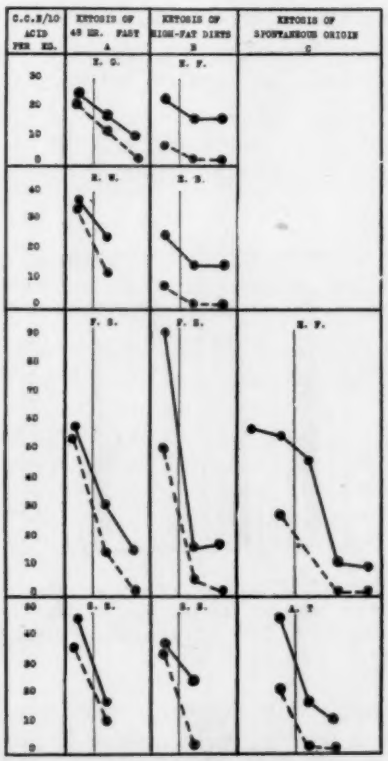

Chart 5.—Reduction of organic acid (solid line) and acetone (broken line) excretion of three normal (E. G., E. F. and E. B.) and seven susceptible children as a result of high-carbohydrate feeding of twenty-four and forty-eight hours' duration. The fore-period ketosis was induced by *A*, fasting; *B*, high-fat diets and *C*, acute infections.

2. Following high fat diets the second group had developed increased excretion of organic acid and acetone (fig. 5 *B*). On reduction of the dietary fatty acid-glucose ratio without change in the caloric intake, there was reduction in ketosis at the end of twenty-four hours. This continued, so that following forty-eight hours of increased carbohydrate intake fore-period figures were obtained in the three cases studied.

3. Two patients (A. T. and H. F.) offered unusual opportunity to observe the effect of high carbohydrate intake on ketosis. Their reactions to various dietary ratios had recently been observed when an exacerbation, apparently of a subacute infection, precipitated severe ketosis. Immediately before the occurrence of ketosis, patient A. T. had ingested a diet with a ratio of 2. H. F. had ingested a similar diet, but had fasted sixteen hours previous to the high carbohydrate intake. There ensued marked ketosis (fig. 5 *C*), accompanied by clinical symptoms of malaise, vomiting, hyperpnea and drowsiness without fever.

A. T. responded quickly to dietary adjustment alone. The excretion of urinary organic acid and acetone fell sharply, following twenty-four hours of diet F.A.1:G.3. However, H. F. required large quantities of carbohydrate by mouth over a period of seventy-two hours, as well as glucose by intravenous injection before the ketosis dis-

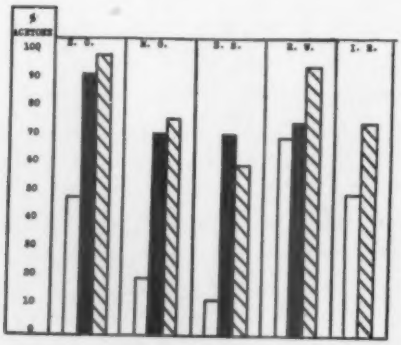

Chart 6.—The percentage of total organic acids in the urine derived from acetone during periods of high-fat feeding and during fasting. In this figure, the blank columns indicate F. A. 2:G. 1; the solid columns, F. A. 3:G. 1, and the etched columns, fasting.

appeared. The severity of the ketosis in this case is indicated by the lowering of the plasma bicarbonate content to 14 per cent by volume.

In the patients observed, the ketosis induced by high fat diets and starvation and that which developed spontaneously (associated with acute infection) were relieved promptly by an increased intake of glucose.

RELATION OF EXCRETION OF ACETONE BODIES TO EXCRETION OF TOTAL ORGANIC ACID

Although in general a high excretion of organic acid was accompanied by a high excretion of acetone, there was considerable variation. These variations were most noticeable during three periods: (*A*) dietary ratios of 2; (*B*) dietary ratios of 3, and (*C*) fasting for forty-eight hours (fig. 6). During the first of these periods (F.A.2:G.1), 39 per

cent of the total organic acid in the urine was accounted for by acetone. This situation changed decidedly with the increase of fat in the diet (F.A.3: G.1), so that 76 per cent of the excretion of urinary organic acid was due to acetone. During the forty-eight hour fast, the absolute amounts of urinary organic acid and acetone were less than with high fat diets.

Our data offer no explanation for these observations.

THE KETOGENIC-ANTIKETOGENIC RATIO IN CHILDREN

In reviewing our data, it seemed of interest to consider their bearing on the ketogenic-antiketogenic ratio in children. The calculations were made according to the formula of Shaffer,[27] which requires the following information: (1) grams of fat and carbohydrate ingested and (2) urinary nitrogen in grams for twenty-four hours. The following formula was used:

$$\frac{K}{AK} = \frac{(15 \times \text{Urinary } N) + (3.45 \times \text{Fat})}{(5.56 \times \text{Carbohydrate}) + (20 \times \text{Urinary } N) + (0.57 \times \text{Fat})}$$

If we assume that one molecule of antiketogenic material insures the combustion of one molecule of ketogenic material, then K minus AK

TABLE 3.—*Comparison of Actual and Expected Excretion of Hydroxybutyric Acid in the Urine on Various Dietary Ratios*

F. A.: G. Ratio of Diet	Patient	Grams of Hydroxybutyric Acid			
			Expected on Molecular Ketogenic-antiketogenic Ratios of		
		Found	1.0	1.5	2.0
1.5	E. B.	1.51	3.55	0	0
	E. F.	0	9.90	0	0
2	F. S.	3.83	14.48	1.52	0
	E. G.	—	13.83	—	—
	M. G.	1.65	11.48	—	—
	S. S.	1.83	14.15	0.28	—
	R. W.	7.11	11.26	—	—
	E. B.	4.50	14.68	—	—
	E. F.	0.58	20.00	—	—
2.5	M. F.	7.70	21.11	5.23	—
	E. B.	1.87	20.72	4.65	—
	E. P.	0.63	29.34	12.38	—
3	F. S.	6.83	25.90	14.19	2.54
	E. G.	3.65	23.04	8.24	—
	M. G.	10.91	40.92	29.95	18.98
	S. S.	5.33	20.03	10.73	1.45
	R. W.	14.39	23.85	9.80	—
	E. B.	1.59	26.00	12.54	—
	E. F.	1.07	35.12	19.02	2.92

gives the excess millimols of ketogenic substance. This, multiplied by 104 (the molecular weight of hydroxybutyric acid) gives the grams of hydroxybutyric acid to be expected from a given diet.

27. Shaffer, P. A.: Antiketogenesis: IV. The Ketogenic-Antiketogenic Balance in Man and Its Significance in Diabetes, J. Biol. Chem. **54**:399 (Oct.) 1922.

These data are shown in columns 3 and 4 of table 3 and disclose the fact that all patients excreted less hydroxybutyric acid than the expected amounts. We made no estimation of the acetone excreted by the lungs, but even if this were approximated at a relatively large amount the discrepancy would still be great. This discrepancy is in accord with the calculation of Shaffer. He assumed that a molecular ketogenic-antiketogenic ratio of 1 represented the threshold of ketosis, but when ketosis was marked the assumption of a ratio of 2 brought the theoretical calculations in much closer accord with actual observations.

In columns 5 and 6 of table 3 are calculations from our data based on ketogenic-antiketogenic ratios of 1.5 and 2, respectively. On viewing these figures, it is apparent that the assumption of a ratio of 1.5 still shows the actual to be much less than the calculated excretion of ketone bodies when the patients were on diets yielding fatty acid-glucose ratios of 3 (Woodyatt) or molecular ratios of 2 (Shaffer). It is only with the assumption of molecular ratios of 2 that the amounts of ketone acids excreted are not considerably less than the calculated amounts.

These results indicate that, to explain the amounts of ketone acids excreted by our patients on the basis of ketogenic-antiketogenic ratios, it becomes necessary to assume that this ratio is often much higher in children than in adults. The calorimeter observations of Wilson, Levine and Rivkin,[21] however, indicate that the contrary is true. They found that the ketogenic-antiketogenic ratio at the threshold of ketosis in children is considerably lower than in adults. If, therefore, we used the ratios found by them instead of those of Shaffer, which apply to adults, our figures showing the discrepancy between actual and calculated excretion of actetone bodies would be even more striking.

Another circumstance in accord with Shaffer's calculation and shown in table 3 is the fact that as the ketogenic value of the diets increases, the calculated amounts of the excretion of ketone bodies become comparatively much greater than the amounts actually excreted. To explain this variation on the basis of definite ketogenic-antiketogenic ratios would necessitate the assumption of ratios that change considerably in relation to different diets. Assuming that the reaction between glucose and ketone-producing fatty acid is a chemical one, it seems inconsistent that the antiketogenic action of glucose should show such great variability.[28]

Our calculations were based on the food ingested and not on respiratory quotients. They have, therefore, inherent sources of error that must be considered. Of first importance is the question of absorption

28. It is true, of course, as has been recognized by Shaffer and others, that the exact nature of this reaction is not perfectly known and that as influencing circumstances become apparent the inconsistencies may largely disappear.

of fat. Although our patients ingested definite and measured amounts of fat, it is possible that a considerable amount may have escaped absorption and therefore may not have had any influence on fat combustion. In this event, the metabolic ketogenic-antiketogenic ratio would vary greatly and perhaps irregularly from that calculated from the diet. We therefore determined the fat in the stools of three patients, E. F., S. G. and E. S., for three day periods while they were on each of the diets.

The results [29] show that there was no significant loss of fat in the stools and, in consequence, most of the fat ingested was properly absorbed. In view of these results and the fact that all of the patients were free from diarrhea or other digestive symptoms, it seems fair to conclude that failure to absorb ingested fat was not a significant source of error in our observations.

TABLE 4.—*The Fat Content in Feces of Children While on Diets with Different F. A. : G. Ratios*

	F. A. : G. Ratios of Diets (Woodyatt)	Ketogenic Grams Available (Woodyatt)	Stool Fat, Grams
E. F.*	1:2	67.8	6.9
	1:1	136.8	5.9
	1.5:1	152.8	7.3
	2.5:1	167.8	4.0
	3:1	171.8	8.1
S. G.†	1:2	65.0	8.9
	1:1	87.4	10.1
	1.5:1	95.0	9.4
	2:1	101.0	10.7
	2.5:1	104.0	—
E. S.†	1:2	73.8	15.0
	1.5:1	156.8	17.8
	3:1	171.8	16.4

* Normal child.
† Susceptible children.

Protein metabolism was based on excretion of nitrogen which would serve to eliminate any error due to faulty absorption of ingested protein.

The possibility of malabsorption of carbohydrate could not be controlled experimentally, and in our calculations we assumed that absorption was quantitative. Deficient absorption of carbohydrate, however, would serve to increase the actual ketone excretion and therefore could offer no explanation for the discrepancy which we observed.

29. Normal stools, even during starvation, always contain fat. Part of this probably represents excretion into the bowel and part is contained in the bodies of bacteria. In addition, part of the fat ingested always escapes in the feces. We have no data on which to base calculations of the actual amount of fat in each fraction. For this reason, we did not consider in our calculations the amount of fat lost in the stools. If we assume, however, that all of the fat in the stools represents fat lost from the food, it makes no material difference in our results. The expected acetone excretion would of course be less than shown in the charts but would still be much greater than the amount actually found. This is evident in table 4.

A circumstance relating to carbohydrate metabolism, which is probably of practical importance, is the utilization of stored glycogen to insure combustion of fat. If this took place, glucose not entering into our calculations might be available, thus yielding an actual ketogenic-antiketogenic ratio greatly different from that indicated by the diet. Indeed, it would be surprising if this did not take place, and its occurrence has been shown by the work of Richardson and Ladd [30] and Richardson and Levine [31] in adults and by the observations of Wilson, Levine and Rivkin [21] in children. We will confine our discussion to the results of the last observers, as their work concerned children, and as we had previously studied two of their patients. They showed by calorimeter observations that the metabolic ketogenic-antiketogenic ratio coincided closely with the ingested food only when the diets were relatively normal in composition. With increase of fat and limitation of carbohydrate, ingested fat was not burned but was stored, and body glycogen was called on to insure combustion of metabolized fat. It is interesting to note to what a large degree this protective mechanism was called into play to render metabolism approximately normal, despite the ingestion of a distinctly abnormal diet.

It seems to us that the unexpectedly low excretion of acetone substances which we observed may be due to restricted combustion of ingested fat whereby a large amount of fat absorbed may be shunted from immediate metabolism to be stored in the tissues of the body. Our results indicate also that this process becomes progressively more active as the ketogenic value of the diet is increased. This is shown by the increasing difference between the actual and calculated excretion of ketone as diets of progressively higher ketogenic values are employed. That the combustion of reserve glycogen is an important influence in limiting ketosis is unquestionable but, owing to conditions pertaining to our subjects, to be related shortly, it is our belief that the more important factor is the limitation of the combustion of ingested fat through its deposition in body tissue. This shunting of fat from actual metabolism has been shown directly by Wilson, Levine and Rivkin,[21] but, entirely aside from their observations, it would seem practically impossible for the stores of glycogen to be sufficiently great to insure combustion of the large amount of fat ingested by our patients. The validity of this assumption is increased by the fact that they were receiving diets of increasing ketogenic values over relatively long periods of time which would seem sufficient to deplete largely the stores of readily available glycogen. That the utilization of stored glycogen does play a part in

30. Richardson, H. B., and Ladd, W. S.: Clinical Calorimetry: 34. Ketosis and Respiratory Exchange in Diabetes, J. Biol. Chem. **58**:931 (Jan.) 1924.

31. Richardson, H. B., and Levine, S. Z.: Clinical Calorimetry: 37. Infection and the Ketogenic Balance, J. Biol. Chem. **63**:465 (March) 1925.

preventing ketosis from the ingestion of diets rich in fat cannot be doubted, but it seems inadequate to explain entirely the low excretion of acetone bodies that we have observed.

For the sake of completeness, it seems necessary to consider briefly the possibility that glucose may be produced from fat. There is no evidence to indicate that fat is regularly and freely converted into glucose. If this were true, ketosis should never occur. If, however, in the absence of readily available glucose a mechanism comes into play which permits the conversion of small amounts of fat into glucose, ketosis might thus be limited and would occur to a much less degree than would be anticipated from the diet. If this occurrence were proved, it would render further discussion of our results unnecessary, as they could be explained adequately by this assumption.

The evidence in favor of the conversion of fat into glucose has arisen largely from the work of Krogh and Lindhard [32] on muscular contraction. Their evidence, however, is not conclusive and there are many observations difficult to reconcile with their views. It is beyond the scope of this paper to enter this discussion, as we have no pertinent evidence of our own to present. The subject has been discussed recently by Himwich, Loebel and Barr,[33] Richardson and Levine [34] and Leathes and Raper.[35]

Judging by the occurrence and mechanism of ketosis, it seems evident that if the conversion of fat into glucose does play a rôle in limiting ketosis it must operate under restrictions and must be conditioned by factors entirely unknown at present. The absence of definite proof of such conversion and the lack of knowledge of its mechanism and regulation, if it does occur, would render present discussion of its possible bearing on our results of little profit.

As suggested before, our results might be explained by the assumption that the ketogenic-antiketogenic ratio varied greatly and that a given amount of glucose could insure the combustion of widely varying amounts of fat. If this were true, ketogenic-antiketogenic ratios would be of little if any significance, and the occurrence of ketosis by feeding limited carbohydrate or excessive fat should be extremely rare.

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32. Krogh, A., and Lindhard, J.: The Regulation of Respiration and Circulation during the Initial Stages of Muscular Work, J. Physiol. **47**:112, 1913; The Relative Value of Fat and Carbohydrate as Sources of Muscular Energy, Biochem. J. **14**:290 (July) 1920.

33. Himwich, H.; Loebel, R. O., and Barr, D.: Studies of the Effect of Exercise in Diabetes: 1. Changes in Acid-Base Equilibrium and Their Relation to the Accumulation of Lactic Acid and Acetone, J. Biol. Chem. **59**:265, 1924.

34. Richardson, H. R., and Levine, S. Z.: Clinical Calorimetry: 39. Exercise and the Respiratory Quotient in Diabetes, J. Biol. Chem. **66**:161, 1925.

35. Leathes and Raper: The Fats, New York, Longmans, Green & Co., 1925, p. 197.

Determination of ketogenic-antiketogenic ratios by the calorimeter does not show a definite and fixed ratio for all children at all times but fails to show variations at all comparable to those calculated from the diets of our patients on the basis of food ingested and excretion of acetone bodies.

Of especial interest is the comparison of the data from the children susceptible to ketosis with those from normal children. On identical diets not only did the children susceptible to ketosis show a much larger excretion of acetone substances, but the actual excretion much more nearly approximated the amount calculated from the diet than did that of normal children (table 3). Wilson, Levine and Rivkin [21] have shown that the metabolic ketogenic-antiketogenic ratio of a patient with cyclic vomiting (patient N. H.) at the threshold of ketosis did not differ from normal, but they observed that their patient burned a larger proportion of ingested fat than did the normal children. It seems possible that this may serve to explain the larger excretion of acetone bodies in our patients with an abnormal tendency toward ketosis. On this basis, we could assume that their greater excretion of acetone substances was not due to a lowered ketogenic-antiketogenic ratio nor to a deficiency of glycogen storage but to a lesser ability to store, or to a greater tendency immediately to burn, ingested fat. It is far from our intention to suggest that abnormal susceptibility to ketosis rests entirely on this simple basis. Many factors unknown at present may be involved, which could influence the combustion of fat and the storage and utilization of fat and glycogen. Our desire is merely to emphasize the storage of ingested fat as one of the factors involved, and perhaps one of considerable importance.[36]

One of the original objects of our investigation was to determine on children the ketogenic-antiketogenic ratio which represents the threshold of ketosis. It is obvious from the foregoing discussion that complicating factors, such as the utilization of stored glycogen and the failure immediately to burn ingested fat, render such calculation from our data of little real value or significance. Such ratios can be determined with reasonable assurance of accuracy only by the calorimeter and are to be found in the paper of Wilson, Levine and Rivkin.[21]

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36. There is a rare type of ketosis in children which bears a close resemblance to diabetic ketosis. The urine contains glucose, the blood sugar is greatly elevated and the administration of glucose, which is so effective in the usual nondiabetic type of ketosis, has little or no therapeutic value. Such cases are rare, but three showing these characteristics have been observed by one of us (O. M. S.). In two, recovery was complete after which there was no evidence of diabetes. The third patient succumbed during the acute ketosis, but prolonged previous observation had shown no signs of diabetes. It seems possible that such cases may be due to an acute injury of the pancreas interfering with its internal secretion. If this is true, insulin should be of therapeutic value.

PROTEIN METABOLISM DURING KETOSIS

It has been definitely established, largely through studies of diabetes and of the metabolism of dogs after removal of the pancreas, that protein serves as an important source of glucose. In both diabetic and nondiabetic ketosis, protein is utilized for its carbohydrate. The influence of this mechanism was shown in our studies of children on ketogenic diets. With increasing ketogenic action of the diets, there was a rise in excretion of total nitrogen expressive of protein catabolism. For example, R. W. excreted 5.4 Gm. of nitrogen on a diet of F.A.1 : G.3, but on a diet of F.A.2 : G.1, the total nitrogen of the urine rose to 10 Gm. Similarly, E. B. showed an excretion of nitrogen 3.8 Gm. on a diet of F.A.1 : G.3, which increased to 7.2 Gm. with the ingestion of a dietary ratio of F.A.2 : G.1.

It is of interest to note that during the forty-eight hour fast the total nitrogen of the urine fell to a level lower than that of the foreperiods (F.A.1 : G.3). This occurrence would indicate that the mechanism directed toward the conservation of protein during starvation overbalanced the tendency to catabolize protein for its antiketogenic fraction. It is probably true also that the decreased catabolism of protein during fasting may have been influenced by the lessened need for glucose due to the diminished combustion of fat.

SUMMARY

By means of diets of gradually increasing ketogenic values, we have studied the reactions of normal children and of children especially predisposed to ketosis. The degree of ketosis, judged by excretion of organic acid and acetone substances, which developed in the especially predisposed children, was notably greater than that which developed in the normal children. This observation serves as a chemical confirmation of their known clinical susceptibility.

It was found that fasting for forty-eight hours resulted in a diminution of the severe grades of ketosis produced by high fat diets in children subject to attacks of ketosis. This seems of interest, since fasting in itself often causes ketosis of considerable degree. The mechanism involved was probably somewhat similar to that which occurs in diabetes. The patients were relieved immediately of the burden of high fat and low carbohydrate intake and glucose from body protein was free to exert a maximum effect on fat metabolism. It seems probable also that the lowered metabolism of starvation exerted a favorable influence. The fact that ketosis diminished during starvation despite abnormally low blood sugar (fig. 2) has a bearing on two phases of the problem of nondiabetic ketosis: first, that recovery was probably not dependent on a large reserve of glycogen and second, that low blood

sugar, either as an index of depleted reserve glycogen or due to some direct influence, is not the determining factor in nondiabetic ketosis of children.

Two children subject to attacks of ketosis showed no excretion of acetone substances during a forty-eight hour fast which followed high-carbohydrate diets. This observation has some bearing on the importance of defective storage of glycogen as a predisposing cause of cyclic vomiting and other forms of severe ketosis in children and would suggest that impaired storage of glycogen is not a constant etiologic factor. The fact that the blood sugar of these patients showed no marked reduction during the fast is definite confirmatory evidence that reserve glycogen was not depleted or sugar mobilization impaired.

Evidence has been presented which indicates that the ketogenic influence of high-fat diets is minimized by diversion of absorbed fat from metabolism and its deposition in the tissues. This observation is in accord with those of previous workers. Shunting of fat from metabolism seemed much less marked in children subject to attacks of ketosis than in normal children. It seems possible that the greater tendency to burn ingested or body fat may be a factor in the abnormal susceptibility of some children to ketosis.

PREMATURE INFANTS

A REPORT OF TWO HUNDRED AND SIXTY-SIX CONSECUTIVE CASES *

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The occurrence of premature birth depends on many causes, which may be divided into those resulting in the expulsion of a healthy premature infant, and those which have a damaging effect on the product of conception. In the first class may be included various injuries, falls, heavy lifting, overwork, or other physical exhaustion and sudden emotional disturbances. Premature rupture of the membranes, either accidental or intentional, occurring in conditions which do not affect the nutrition of the ovum, as in pelvic and spinal deformity in the mother and in placenta praevia, also may be included.

The conditions that fall within the second category all react to a greater or lesser degree on the fetus, some producing only momentary weakness, as the milder acute infections, and others causing a weakened physical condition as a result of their long-continued action on the nutrition and development of the fetus.

In our group of 266 cases (table 1) there were three instances of placenta praevia; five cases of induced labor for pelvic deformity and other conditions, and three cases in which labor was precipitated by automobile accidents.

In our series, there were eight cases of congenital syphilis; five cases in which the mother had open tuberculosis; twenty-one cases of toxemia of pregnancy; two of acute nephritis; six of advanced heart disease; one of diabetes, and four cases of acute infection necessitating abdominal operation with resulting premature labor.

Multiple pregnancy was the most common single cause of premature labor. Many of these also showed evidence of impaired vitality. Seventy-eight of the 266 infants reported were the product of multiple conception. Two of these were from a triple pregnancy. Both died (a male and a female). The other infant, a female, died shortly after delivery. The remaining seventy-six infants represent fifty twin pregnancies. Of the total 100 infants, twenty-four died shortly after birth or before they could be transferred to the station. Of the fifty twin

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pregnancies, eleven pair were males and of these, two pair and two individual infants lived. There were eighteen pair of females, four pair and one each of eight other pair living. Of the twenty-one pair of twins of opposite sex, five pair lived; six females and one male also lived. Of the seventy-eight infants from multiple pregnancies who were admitted to the hospital, the mortality was 50 per cent.

Nine infants from multiple pregnancies weighed under 1,000 Gm., and all died; of twenty-four who weighed between 1,000 and 1,500 Gm., eight lived; of thirty-one who weighed between 1,500 and 2,000 Gm., twenty-two lived; of seven who weighed between 2,000 and 2,500 Gm., five lived; three weighed more than 2,500 Gm. and all lived; of four whose weight at birth was unknown, one lived.

TABLE 1.—*Etiologic Factors Influencing Termination of Pregnancy*

	Birth Weights							
Etiology	Less Than 1,000 Gm.	From 1,000 to 1,500 Gm.	From 1,500 to 2,000 Gm.	From 2,000 to 2,500 Gm.	From 2,500 to 3,000 Gm.	Birth Weight Unknown	Total	Died
Diseases of Mother								
Syphilis	2	..	4	1	..	1	8	5
Tuberculosis	1	1	1	1	1	..	5	3
Toxemia of pregnancy	3	6	5	4	2	1	21	4
Nephritis	..	..	1	..	..	1	2	1
Heart disease	..	2	..	2	1	1	6	1
Diabetes	..	1	..	..	..	..	1	1
Acute infections necessitating operation	..	1	1	1	1	..	4	1
Placenta praevia	..	2	1	..	..	..	3	1
Induced labor other causes (forceps and cesarean)	..	1	2	1	1	..	5	2
Multiple pregnancy	9	24	31	7	3	4	78	39
Accidental trauma (auto accidents)	..	..	1	2	..	..	3	1

TABLE 2.—*Infants Born of Multiple Pregnancy*

	Under 1,000 Gm.	From 1,000 to 1,500 Gm.	From 1,500 to 2,000 Gm.	From 2,000 to 2,500 Gm.	From 2,500 to 3,000 Gm.	Birth Weight Unknown	Total	Males	Females
Number admitted	9	24	31	7	3	4	78	30	48
Number that died	9	16	9	2	..	3	39	18	21
Number that lived	0	8	22	5	3	1	39	12	27

The mortality of the males of the fifty twin pregnancies was 70 per cent and of the infants admitted, 60 per cent. The mortality of the females was 53 per cent and of those admitted, 48 per cent.

PLACE OF BIRTH

The higher mortality of the group of infants born at home indicates the importance of early care and especially of maintenance of a nearly normal body temperature. Transportation was undoubtedly a large factor.

Seventy-three were born in Michael Reese Hospital; fifty-three in other hospitals, and 140 in homes.

We wish to emphasize the fact that this station received only 27.4 per cent of its cases from its own institution. In Chicago, few institutions will accept into their nursery wards infants born on the outside, and unfortunately only a few hospitals have their children's wards equipped to meet the needs of prematurely born infants.

Due to the high mortality among infants who have a markedly subnormal temperature when brought to the station, (table 4), the hospital attempts whenever possible to send a member of its staff for the infant.

TABLE 3.—*Place of Birth*

Birth Weight in Grams	Born at Home	Living	Dead	Born in Hospital	Living	Dead
Less than 1,000	18	0	18	5	0	5
From 1,000 to 1,500	36	10	26	29	12	17
From 1,500 to 2,000	50	32	18	52	30	22
From 2,000 to 2,500	19	10	9	32	26	6
From 2,500 to 3,000	6	6	0	4	3	1
Unknown	11	7	4	4	2	2
Totals	140	65	75	126	73	53
Mortality, per cent	53.5			42.0		

TABLE 4.—*Temperature at Admission—Relation to Mortality*

	90 Degrees		92 Degrees		93 Degrees		94 Degrees		95 Degrees		96 Degrees		97 Degrees		98 Degrees		99 Degrees	
Weight in Grams		Died		Died		Died		Died		Died		Died		Died		Died		Died
Under 1,000	2	2	3	3	1	1	4	4	1	1	5	5	2	2	..	..	1	1
From 1,000 to 1,500	1	1	2	0	5	5	14	11	6	6	18	10	5	2	4	3	..	..
From 1,500 to 2,000	1	1	1	1	4	3	10	7	9	4	19	7	19	6	23	5	5	1
From 2,000 to 2,500	..	..	1	1	2	2	3	1	1	1	1	1	19	5	10	2	4	1
From 2,500 to 3,000	..	..	..	..	..	..	..	..	..	..	1	1	2	..	5	..	1	..
Birth weight unknown	..	..	1	1	..	..	2	2	..	..	..	..	2	2	2	2	1	1
Totals	4	4	8	6	12	11	33	25	17	12	44	24	49	17	44	12	12	4
Died		100%		75%		91%		76%		70%		54%		35%		27%		33%

To facilitate transportation of these infants with a minimum exposure, one of us has designed a small hand ambulance, about twice the size of an obstetrical bag, equipped with a special electric heating unit which may be attached to a 110 volt household current, to the 32 volt light system of a Pullman car or to the pilot lamp socket on the dash of an automobile.

PATHOLOGY

Of the infections occurring in the station, the clinical diagnosis was as follows: Otitis media (purulent) occurred in thirty-six infants, sixteen of whom died (with complications); pyelocystitis was diagnosed thirteen times, and all of these infants recovered; severe diarrhea developed in thirty-six infants, with twenty-three deaths, and septic

meningitis in three, all of whom died. There were twenty-seven deaths from bronchopneumonia.

A number of these infants developed more than one of the infections listed. Congenital syphilis was diagnosed in a surprisingly small number of our cases, notwithstanding the fact that a blood Wasserman test was made on at least one of the parents. In eight cases diagnosed as congenital syphilis, five of the infants died.

Upper respiratory infections, except in the cases in which they were complicated by systemic infections, were not fatal. Pyodermia was noted in fifteen cases with four deaths.

Of the 128 infants who died, autopsies were performed on seventy-nine (table 7). As might be expected, bronchopneumonia was present in a large number of the patients having atelectasis. Intracranial hemorrhage was present in 49 per cent of these cases in which the skull was opened. Of thirty-two infants showing intracranial hemorrhage at post mortem, eleven were delivered by forceps. Of the intracranial hemorrhages, thirteen were supratentorial, seventeen were infratentorial, and two were in the ventricles.

The malformations present were as follows: horseshoe kidney, four cases; club feet, five cases; cleft palate, two cases; bifid uvula, one case; spina bifida, one case; supernumerary digits, two cases, and diaphragmatic hernia, one case.

DESCRIPTION OF STATION

A brief description of the premature infants' station at the Sarah Morris Children's Hospital of the Michael Reese Hospital might be of interest. The station consists of three rooms, one of which is used for normal infants, one for infected cases, and the third for infants who are being prepared for removal to their homes. The station has a capacity of twenty infants. There is no special provision for ventilation and humidity, the ventilation being supplied by transoms and doors as in ordinary hospital wards; as indicated, the air is moistened by the sprinkling of sheets suspended from a metal screen frame. The special equipment consists of twelve electrically heated, water jacketed beds; electrically heated dressing tables; a hygrometer; a thermometer for registering high and low temperatures; a time clock and a quartz lamp. Three or four wet nurses are required to supply breast milk used in the station, as all the young infants are fed with human milk. No infants are nursed at the breast in the station. The wet nurses empty their breasts at regular four hour intervals with an electrically driven pump, or by hand expression. When there is any doubt as to the quality of the breast milk, it is boiled for one minute. We believe that one of the great advances made in the institution has been in the nursing care of the infant. This has been made possible by the endowment of the

institution by the Infant Aid Society of Chicago, which provides the salaries for the nurses, and which also furnished the major portion of the equipment for the station.

The infants are under the care of a graduate nurse who has under her direction three or more assistants. The nurses are permanently on duty in the station. Nurses in training are not used in this service, an exception being made for those of the undergraduate nurses who especially desire this training.

During the infant's stay in the hospital, a social service worker visits the home or meets the mother at the hospital and instructs her in the care of her breasts, so as to maintain the supply of breast milk whenever possible.

Maintenance of the Mother's Breast Milk.—Regular four hour expression is encouraged, the mother being supplied with sterile bottles so that she may bring her milk to the station. As soon as the infant's physical condition allows, the mother is asked to come to the station at stated times to nurse her infant directly at the breast. If possible, this is done daily. This stimulates the milk supply and encourages the mother in her effort to produce milk for the future use of the infant. It also has a valuable educational feature so far as the infant is concerned.

Before the infants are discharged from the station, the worker visits the home and instructs the mother in the necessary preparation for the infant's return. Following the discharge from the hospital, the social worker visits the home one or more times weekly, as may be indicated, until the infant's health and the weather conditions make visits to the special clinic held for them at Sarah Morris Hospital advisable. This applies only to those infants not having a private physician and to those whose private physicians desire them to be taken to the clinic.

Method of Feeding.—The great majority of the infants are fed with a medicine dropper until they are strong enough to take food from a bottle. Catheter feeding is instituted when indicated, when the infant is unable to swallow properly or when feeding by the dropper precipitates attacks of cyanosis.

When to Start Regular Feeding.—The question of when to start regular feeding is of great importance to these infants, because of the tendency to develop acute inanition. Therefore, a regular feeding regimen must be started early. Human milk is essential to a low mortality.

Feeding During the First Day.—It is our custom to withhold milk for twelve hours from infants received shortly after birth, until the respiratory and circulatory functions are well established. During the second twelve hours, from one to three feedings of breast milk may be given if the infant's condition warrants.

Infants received several days after birth, which is true of many of our cases, must of necessity be fed according to their condition when received at the station.

Feeding From the Second to the Tenth Day.—The second to the tenth day may be grouped together as the second feeding period, for practical purposes.

From the second day the infants should be fed regularly day and night, the number and time of feedings depending to a great extent on whether the food is given with or without the use of a catheter; on the gastric capacity, and on the infant's general condition. Practically all our infants at first receive eight feedings daily.

Beginning (in most cases by the second day) with from 20 to 40 cc. of human milk per kilogram of body weight, the quantity may be increased by from 8 to 15 cc. daily per kilogram until, usually by the tenth day, feedings averaging from 80 to 140 cc. per kilogram can be given.

Further fluids, preferably inert, such as water or 1 per cent lactose solution, are administered to compensate for the loss of body fluids through the kidneys, bowels, lungs and skin. The infant requires about one sixth of its body weight of water, inclusive of that contained in the milk, in twenty-four hours while in the heated bed. Such quantities, however, should not be attempted on the first days; usually it will be possible to approximate one eighth of the body weight in total fluids by the fourth day. The early feedings must necessarily be small and the increased feedings given gradually.

Individual Feeding of Each Infant.—The infants must be considered individually, as it is impossible to formulate definite rules for feeding, at least during the first ten days.

1. We must have a definite idea of the minimum food requirements for life.

2. The amount of food necessary to maintain at least a stationary weight must be given.

3. The amount of food needed to meet the requirements for growth and development must be given.

Approximately one seventh of the body weight of fluids and human milk of a food value of 70 calories per kilogram every twenty-four hours are required to maintain life. Little can be expected in the way of increase in weight until 90 calories are reached, and, depending on the weight, body surface and physiologic development, the later needs of the infants will approximate from 100 to 140 calories per kilogram of body weight. In exceptional cases, it may be necessary to feed breast milk in amounts equaling from 160 to 200 calories per kilogram. Such infants are usually markedly underweight for their fetal age.

To fulfil all their needs, infants will therefore require from 140 to 200 cc. of breast milk per kilogram, or about one seventh to one fifth of their body weight daily. They can, however, maintain life on 100 cc. and hold their weight in most cases on 130 cc. per kilogram. In exceptional cases, we have fed as high as 300 cc. per kilogram in underweight infants. The latter must be carefully observed for signs of overfeeding, such as vomiting, gastric dilatation and cyanosis.

AVERAGE HUMAN MILK DIETS REQUIRED BY PREMATURE INFANTS DURING THEIR FIRST TWENTY-ONE DAYS

In larger infants, the milk can be increased more rapidly after the tenth day, usually by 15 and occasionally by 20 cc. a day, until from 140 to 200 cc. (from 100 to 140 calories) per kilogram are fed, the methods of giving food as well as its frequency being dependent on the general development of the infant.

The size of individual feedings will vary with the method of feeding. When the infants are fed by the catheter, from six to eight feedings a day are given, with an average of from 4 to 6 cc. per feeding during the second day. The feedings are now increased daily by an average of 2 cc. per feeding. When the feedings are given from the bottle or by dropper, smaller feedings are usually given more frequently—usually from eight to ten daily, although twelve may be needed when larger feedings are not retained. From 2 to 4 cc. are given at first, and increased by 1 to 2 cc. per feeding on each succeeding day, until from 140 to 200 cc. per kilogram per day is reached.

The food and water to be administered should be noted in writing for the nurse's instruction each day, after a thorough inspection of the infant and its clinical chart.

The diet of a premature infant making a satisfactory gain in weight should not be changed arbitrarily without a well-defined indication.

Feedings After the Twenty-First Day.—Usually by the twenty-first day, the food requirements of the infant are well established and a careful observation of the weight, stools, disposition and, which is equally important, its body temperature will decide the future food requirements.

The water requirement will, to a great extent, be dependent on the supply of artificial heat and the presence of fever.

As the infant takes on weight and becomes fat, with a rounding of the features and the body, as is the case in premature infants successfully fed on breast milk, the total amount of the milk administered can be held at one-sixth and not infrequently at one-seventh of the body weight, and normal increases in weight may still be maintained.

ARTIFICIAL FEEDING

In the feeding of premature infants, there can be no comparison between the results to be expected from human milk and those to be obtained with artificial food. This is especially true of infants with a weight below 1,500 Gm. Therefore, if it becomes necessary to resort to artificial feeding, the selection of a food, its preparation and its adaptation to the infant must all be given the most paistaking consideration. Many varieties of artificial diet have been suggested by many different authors, such as simple milk dilutions, cream and top-milk mixtures, skimmed milk and buttermilk preparations, malt soup preparations and condensed and evaporated milk. The results with these various diets are to a great degree dependent on the physician's intimate understanding and directions for the use of the individual food.

Quantity of Food in Artificially Fed Infants.—It must be remembered that the figures quoted for the feeding on breast milk are the maximum that can be assimilated and are excessive quantities for artificial feeding in the first weeks of life because of greater difficulty in the digestion of cow's milk. When artificially fed, these infants must at all times be closely watched for evidence of overfeeding, and the first evidence of digestive disturbances or of intercurrent infections should lead to the feeding of human milk whenever possible.

From the foregoing statement, it is evident that smaller and slower increases in weight may be expected of the artificially fed.

Most clinicians have obtained the best results with the feeding of low-fat mixtures. We have found boiled milk, skimmed milk and buttermilk, with carbohydrates added, among the best, when chymogen milk was not available.

Food Used.—In our station, we have limited the cow's milk feedings when instituted to chymogen milk, skimmed and whole cultured lactic milks and boiled skim and whole sweet milks.

Chymogen milk is milk which has been boiled five minutes and to which chymogen powder (rennet + milk sugar) has been added. Its preparation is as follows:

Milk
Single boiler, 1 or 2 quart
Dairy thermometer
Chymogen powder
Teaspoon
Egg beater

Directions for Preparation.—Boil milk for five minutes over direct flame; cool to 104 F., and add one full teaspoonful of chymogen to each quart of milk, and stir for one-half minute. Let it come to a clabber by allowing it to stand for fifteen minutes, holding it as near 100 F. as possible by keeping it in a warm place; then beat it well until the curd is finely divided. Put it in individual feeding bottles and place on ice. Do not heat above 100 F. when preparing individual bottles for feeding; otherwise, curds will clump and will not pass

through the nipple. Reheating is best accomplished by placing the individual feeding bottle in a cup of warm water not more than 115 F. and allowing it to stand for ten minutes. Replenish the warm water if necessary.

Chymogen milk has given us most satisfactory results in the artificial feeding of premature infants. The latter preparation is little more than a boiled milk in which the curds are precipitated in a fine, flocculent form, about the size of that of human milk, before it is fed to the infant. Because of the fine curd, it can be fed with less diluent than ordinary milk mixtures. This food should be started with one part of chymogen milk and one part water, following the directions for increases in quantity as given for human milk. Often, by the second or the fourth week, a two-thirds chymogen mixture can be fed. Because of the low carbohydrate content of such mixtures, 1 Gm. of cane sugar or lactose per kilogram of body weight should be added after the first few days, and the amount gradually increased to 3 Gm. per kilogram.

TABLE 5.—Admission by Years *

	1922		1923		1924		1925		1926			
Birth Weight	Living	Dead	Living	Dead	Living	Dead	Living	Dead	Living	Dead	Total Admission	Total Living
Under 1,000 Gm.	0	2	0	5	0	5	0	4	0	7	23	0
From 1,000 to 1,500 Gm.	5	2	2	6	0	9	7	11	8	15	65	22
From 1,500 to 2,000 Gm.	4	1	8	4	10	0	13	5	27	21	102	62
From 2,000 to 2,500 Gm.	1	0	1	1	5	5	12	3	17	6	51	36
From 2,500 to 3,000 Gm.	0	0	1	0	1	0	3	0	4	1	10	9
Birth weight unknown	1	3	0	0	0	3	8	0	0	0	15	9
Totals	11	8	12	16	16	31	43	23	56	50		
Total admissions	19		28		47		66		106		266	138

* Approximately 75 per cent of these admissions were charity cases.

When insufficient amounts of human milk are obtained, artificial feeding should be used as a supplement and not as a substitute. The milks may be mixed.

Other Dietetic Requirements.—To counteract the effects of boiling, the feeding of orange juice should be instituted by the third week, beginning with 0.5 cc. (8 drops) and increased to 2 to 4 cc. (½ to 1 drachm) daily by the eighth week, in order to avoid scurvy. Cod liver oil as an antirachitic should be fed by the fourth week, beginning with 0.5 cc. (8 drops) daily divided into two feedings and increased to 2 cc. (30 drops) daily by the eighth week. It may be mixed with the orange juice. To counteract the low iron content of these diets, carbonate of iron in 0.03 Gm. (½ grain) doses or citrate of iron and ammonia in 0.03 Gm. (½ grain) doses once daily should be started by the fourth week. The latter may be prescribed in solution. More recently, we have added raw egg yolk to the breast milk or artificial feeding to meet the iron requirement of these infants.

Exposure to the quartz light is given daily as early as the third week, the time of exposure being dependent on the individual infant.

PROGNOSIS

Of 266 infants admitted to this station, 138 lived and were transferred to their homes (table 5). This represents 51.9 per cent. Excluding the patients who died in the first twenty-four hours, 65.1 per cent survived. The high mortality of the first twenty-four hours, while in large part due to immaturity, is influenced greatly by outside factors, such as previous care and transportation.

TABLE 6.—*Data of Vitality*

Birth Weight	Total Admission	Surviving First 24 Hours		Surviving First 96 Hours		Graduated		Per Cent Graduated of Those Surviving First 24 Hours
		Number	Per Cent	Number	Per Cent	Number	Per Cent	
Under 1,000 Gm.	23	11	47.8	11	47.8	0	0	0
From 1,000 to 1,500 Gm.	65	47	72.3	43	66.1	22	33.8	46.8
From 1,500 to 2,000 Gm.	102	84	82.3	80	78.4	62	60.7	73.8
From 2,000 to 2,500 Gm.	51	47	92.1	46	90.1	36	70.5	76.5
From 2,500 to 3,000 Gm.	10	10	100.0	10	100.0	9	90.0	90.0
Birth weight unknown	15	13	86.6	11	73.3	9	60.0	69.2
Totals	266	212	79.6	201	75.5	138	51.9	65.1

TABLE 7.—*Observations at Autopsy in Seventy-Nine Cases*

Pathologic Change	Number of Times Reported Cases Grouped According to Birth Weight in Grams					
	Under 1,000	From 1,000 to 1,500	From 1,500 to 2,000	From 2,000 to 2,500	Unknown	Totals
Atelectasis	9	18	8	8	3	46
Bronchopneumonia	2	5	6	7	3	23
Intracranial hemorrhage	5	12	7	7	1	32
Meningitis	1	2	..	1	..	4
Epicardial hemorrhage	1	1	2	..	1	5
Patent foramen ovale	4	11	8	4	2	29
Patent ductus arteriosus	3	11	8	4	3	29
Syphilis	1	..	2	2	..	5
Otitis media (purulent	2	2	5	3	..	12
Malformations	1	2	3	4	2	12
Number of autopsies	12	24	21	15	7	79

INFANTS GRADUATED FROM THE STATION

The mothers of the artificially fed infants are given instruction in the preparation of the feedings by the dietitian in the hospital milk station before the infants are discharged. At first, weekly visits are desirable if the weather and other conditions permit. The infants are weighed, examined and the necessary instructions given as in any other infants' clinic. Exposure during examination is avoided. As the infants grow older, longer intervals between visits (four or six weeks) are allowed. After reaching the age of 2 years, they are transferred to the infant clinic at the Michael Reese Dispensary.

The majority of infants are artificially fed when leaving the station, although in all cases, unless directly contraindicated, the mother has been encouraged to keep her breast secreting by means of expression. When the mother has been able to keep her supply of milk, infants are fed at the breast on leaving the station. Complimentary feedings may be necessary. Chymogen milk mixtures are used, and are usually started before the infant leaves the station. In the artificially fed infants, we have often continued the chymogen feedings throughout the first year. Some of the larger infants are changed to simple milk, water and sugar mixture before this time. Other smaller infants remain on chymogen milk for longer periods—from fourteen to sixteen months. Six feedings in twenty-four hours are usual after discharge from the station. The average amount of milk fed varies with the infant, being usually from 100

TABLE 8.—*Observations at Autopsy in Seventy-Nine Cases*

	Cases Grouped According to Age at Time of Death					
Pathologic Change	Day	2 to 7 Days	7 to 21 Days	21 to 30 Days	30 to 60 Days	Over 60 Days
Atelectasis	15	14	12	1	4	..
Bronchopneumonia	1	4	6	6	4	2
Intracranial hemorrhage	9	16	4	1	2	..
Meningitis	..	1	2	1	..	..
Epicardial hemorrhage	3	2	..	..	..	..
Patent foramen ovale	11	10	3	3	2	..
Patent ductus arteriosus	7	9	6	4	3	..
Syphilis	..	1	1	1	2	..
Otitis media (purulent)	..	1	8	2	1	..
Malformations	2	3	3	2	2	..

to 130 cc. with from 6 to 7 Gm. of sugar added for each kilogram of body weight. The amount of water added depends largely on the infant. Some infants who are able to retain only small feedings are fed more concentrated mixtures, additional water being fed between feedings. From 8 to 12 cc. of cod liver oil in one or more doses is given daily. Orange juice is also given daily in amounts of from 20 to 45 cc. Iron is given to combat the anemia invariably present in these infants. One or 2 grains (0.06 or 0.13 Gm.) of iron and ammonium citrate is the preparation used. Raw egg yolk added to the milk mixture is an additional source of iron.

Cereal is added to the diet about the sixth month of life. Vegetable soup is given by the seventh or eighth month. During the last of the first year, these infants may be fed much as full term infants.

Future Development.—Of the ninety-three patients followed in our clinic for infants graduated from the station, seven died and five had pneumonia. Two of these developed pneumonia during the course of measles. Seventeen of the infants have had measles and nine, pertussis.

Respiratory infections have been no more frequent than in full term infants. Two have had tonsillectomy performed without any unusual complications. The one syphilitic infant followed had a negative Wassermann reaction by the nineteenth month. While many of the infants show minor, and a few moderate, degrees of rickets, only a small number have developed marked manifestations. We believe that this is due to the fact that cod liver oil and quartz light therapy were introduced when the infants were 2 or 3 weeks of age. We have not had any cases of rickets in which mechanical appliances or surgical intervention were necessary to correct deformities.

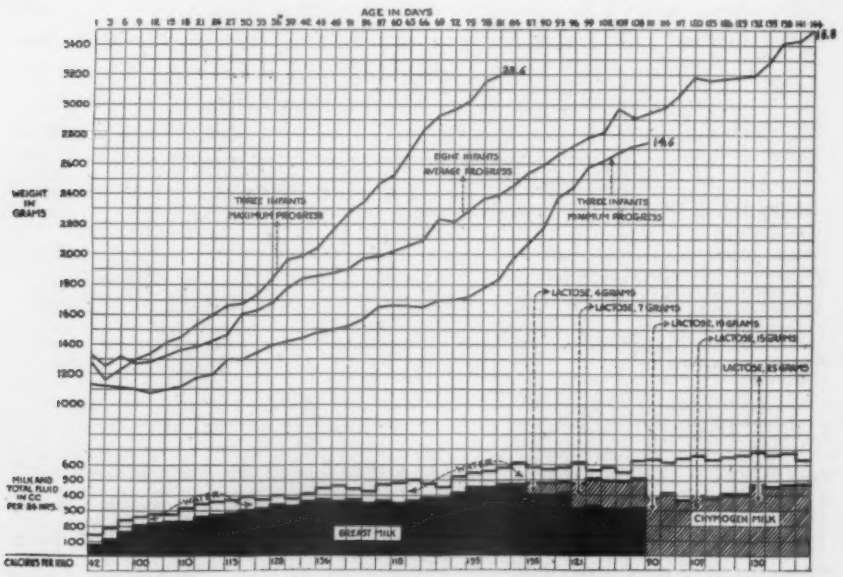

Chart 1.—Record of fourteen premature infants, weighing from 1,000 to 1,500 Gm. at birth. In this chart and in charts 2, 3, and 4, the figures at the end of the solid lines indicate the average daily gain in grams.

Megacephalus, while occasionally seen, disappears early; this is due, we think, to the early addition of cod liver oil to the diet together with daily exposure to the ultraviolet ray. Active signs of tetany did not develop in any of the infants of our series.

Teething has been delayed, as would be expected; however, nineteen of our infants had one or more teeth during the seventh month. As a group, by the eighteenth to the twenty-fourth month, they closely resemble full term infants in physical and in mental development. There are no apparent mental defectives in our series. Nature has wisely removed those not fitted to survive.

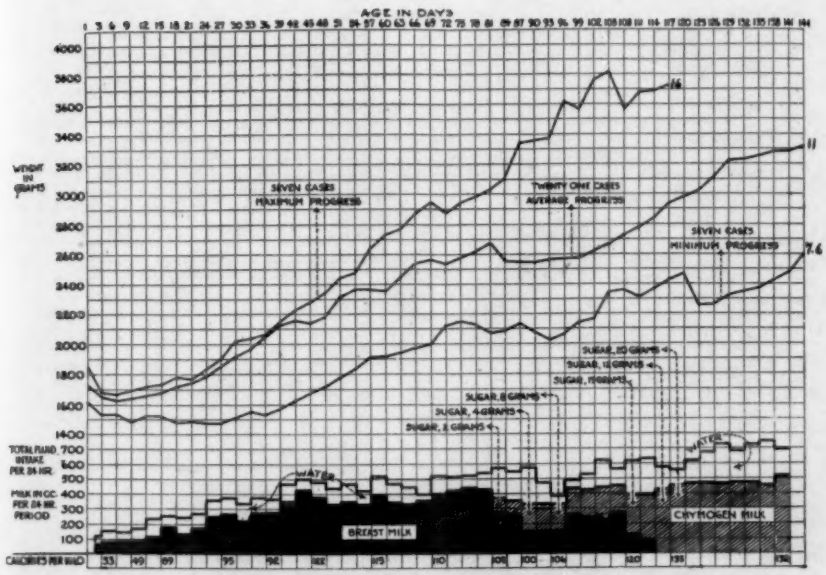

Chart 2.—Record of thirty-five premature infants, weighing from 1,500 to 2,000 Gm. at birth.

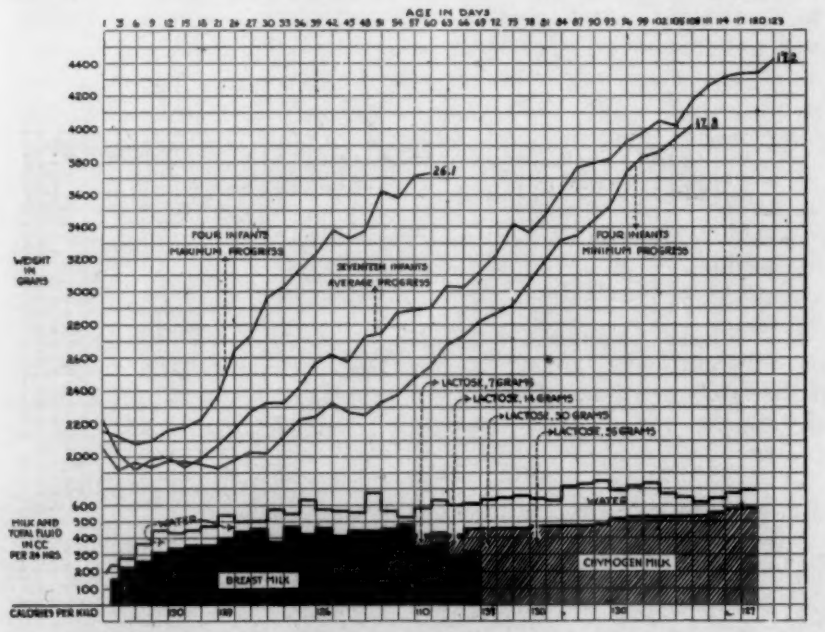

Chart 3.—Record of nineteen premature infants, weighing from 2,000 to 2,500 Gm. at birth.

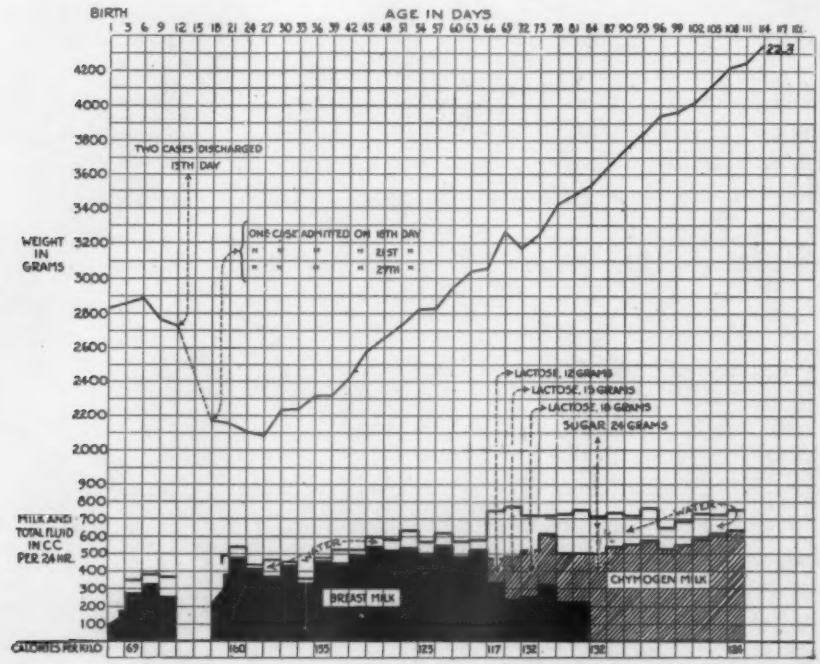

Chart 4.—Record of five premature infants, weighing from 2,500 to 3,000 Gm. at birth.

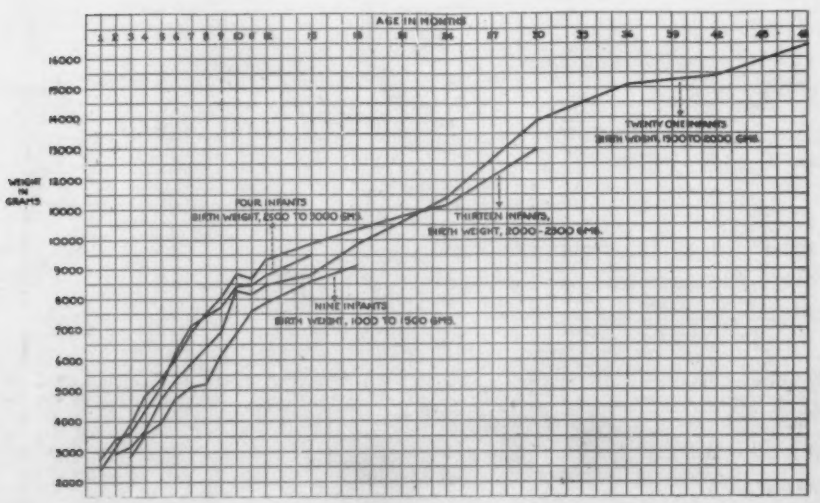

Chart 5.—Record of forty-seven premature infants followed after graduation from the station.

THE EARLY OCCURRENCE OF GASTRIC HEMORRHAGE IN CHILDREN WITH SPLENOMEGALY*

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The occurrence of gastric bleeding in childhood is relatively uncommon. The sudden onset of profuse and alarming hematemesis in a child who has been previously well is rare. Our attention has been called to this condition by the appearance in the Children's Hospital of four children presenting this symptom: three within the last two months and one within the last three years. One child has been seen in private practice.

The usual varieties of bleeding from the stomach in young children vary somewhat in their causes from those frequently seen in adults, but there is no cause in adults, except malignant disease, which may not be operative in children. The primary diseases of the blood, notably purpura and hemophilia, and occasionally scurvy and malaria, are accompanied by gastric bleeding. A foreign body in the stomach may produce hemorrhage. Gastric ulcer in children is rare, but does occur. A particular type of ulceration, described by Dieulafoy [1] and known as "exulceratio simplex," is sometimes present; it consists of a minute opening into a blood vessel of sufficient size to produce a large hemorrhage. Capillary bleeding has been reported (White) in which no ulcers or abrasions were demonstrated. The nature of the oozing from the capillary bed of the stomach is not clear. It is probably a secondary condition associated with toxemia, jaundice, diseases of the blood or coexistent chronic inflammation of the appendix or gallbladder. Severe bleeding from varicose veins of the stomach or esophagus is not uncommon in Banti's disease, splenic anemia or thrombophlebitis of the portal and splenic vein. Splenomegaly and usually a secondary anemia are associated with these conditions. In Banti's disease, a leukopenia also is usually present, except immediately after a hemorrhage. Ascites is frequently present, and cirrhosis of the

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1. Dieulafoy: Bull. Acad. de méd., Paris, 1898.

liver occurs in the late stage of the disease. Sometimes there is an enlargement of the superficial abdominal veins.

Wallgren [2] has recently reported four cases of gastric hemorrhage in young children, which correspond exactly to the cases in the children whom we have seen. He has also collected reports of eleven other cases from the literature with the same clinical picture. We have found the reports of six other cases which were not mentioned by him. Together with our own five cases, these make a group of twenty-six children presenting a characteristic picture. There must also be many other cases of this condition in the literature reported under the name of Banti's disease, splenic anemia or thrombophlebitis of the portal and splenic vein.

The symptoms common to all of these cases are as follows: A child previously well and whose history contains nothing which attracted unusual attention suddenly vomits a large amount of bright and clotted blood. The hemorrhage may be so severe as to require immediate transfusion or in some cases to prove fatal. The physical examination of these children made immediately following a hemorrhage reveals no evidence of disease except a secondary anemia. If the examination is made somewhat later and before another hemorrhage takes place, a marked enlargement of the spleen is found. Repeated hemorrhages at longer or shorter intervals may occur, from any one of which death may result. The hemorrhages may cease spontaneously and the child apparently entirely recover. The spleen, however, remains large. The secondary anemia disappears. The striking things about these children are the early appearance of hemorrhage without previous symptoms of illness, the absence of any marked leukopenia, the variation in the size of the spleen after hemorrhage and the long course of the disease without the development of changes in the liver or any considerable ascites.

The details of our five cases are as follows:

REPORT OF CASES

CASE 1.—A girl, aged 5, was brought to the Children's Hospital for severe bleeding from the stomach. There was no history of hemophilia or other diseases of the blood in the family and no known exposure to tuberculosis. Five months before entry, the child had tonsillitis and required care in bed for six weeks. She had otherwise always been well. The day before admission to the hospital, she suddenly complained of pain in the abdomen and vomited a large amount of dark, clotted blood, estimated at 1 pint. She was weak and pallid for the rest of the day. The following day, two hours before entry to the hospital, she vomited a cupful of dark, clotted blood. The physical examination was entirely negative, except that she was pale and listless. The spleen and liver were not palpable.

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2. Wallgren, Arvid: Contribution to the Study of Splenomegaly in Infancy, Acta Pediat. (sup.) **6**:1, 1927.

Examination of the blood showed: hemoglobin, 29 per cent; red cells, 1,200,000; leukocytes, 8,000, and platelets, normal. The fragility of the red cells was normal, and the bleeding and clotting times were normal. The Wassermann and tuberculin tests and the roentgen-ray examination of the gastro-intestinal tract were negative. Transfusion was performed at once. Two weeks later, splenic enlargement was noted. Two months later, the hemoglobin was 77 per cent; the red cells, 3,980,000; leukocytes, 8,800, and the spleen 5 cm. below the costal margin. We have followed this child for four years and she has not shown any further gastric bleeding. She is in good condition.

CASE 2.—A girl, aged 3, was brought to the Children's Hospital for bleeding from the stomach. There was no history of hemophilia or diseases of the blood in the family and no known exposure to tuberculosis. The past history was unimportant, except that her local doctor had found that she had an enlarged spleen when she was 1 year old. She had been treated for malaria. Two weeks before entry she became restless and chilly and vomited half a teacupful of dark, clotted blood. She had a second hemorrhage of about the same amount of blood just before admission to the hospital. When she entered, she was extremely pale and prostrated. The spleen was not palpable, and the superficial glands were not enlarged. Hemoglobin was 20 per cent; red cells, 1,800,000; leukocytes, 8,000, and platelets, normal, and there was no evidence in the smear of any disease of the blood. The bleeding and clotting time, the icteric index and the fragility test were normal. The blood culture, Wassermann and tuberculin tests and gastro-intestinal roentgenograms were negative. The blood steadily improved after immediate transfusion, and one month after entry the hemoglobin was 65 per cent and the red cells were 4,000,000. Two days after the first transfusion, the spleen was palpable 4 cm. and two months later 5 cm. below the costal margin. She had had no further hemorrhage during the last two months. Her condition was good.

CASE 3.—*History.*—A girl, aged 3, was brought to the Children's Hospital for bleeding from the stomach. There was no history of hemophilia or chronic disease of the blood in the family. The mother had tuberculosis. At birth, there was an umbilical infection and general sepsis. During the first year of life, she was admitted several times to the Infants' Hospital. She always had a secondary anemia but never any bleeding. At her fifth entry, at the age of 1 year, the liver was 4 cm. and the spleen was 3 cm. below the costal border. She had been well during the year before the present entry. Two days previously, she suddenly began vomiting blood and was brought to the hospital in a serious condition. She was pale, had a rapid pulse, and a few purpuric spots over the tibiae. Her spleen was not palpable. The hemoglobin was 50 per cent; red cells, 2,800,000, and leukocytes, 6,000, and the smear was not characteristic of any disease. The platelets were normal. The bleeding and clotting time, the fragility test and the icteric index were normal. Transfusion was immediately performed. The blood cultures, Wassermann and tuberculin tests and gastro-intestinal roentgenograms were negative. Bleeding from the stomach continued, and during the following month of observation, she bled once so freely that she required a second transfusion of blood. The spleen rapidly increased in size to 5 cm. below the costal margin. The spleen was removed one month after entry by Dr. W. E. Ladd. At operation, there was no demonstrable anomaly of the splenic vein and no thrombosis or interference with the splenic circulation. There were a few vascular adhesions between the upper pole of the spleen and the diaphragm. There was a large prominent spigelian lobe of liver, but this did not apparently press on the splenic

vein. The veins of the stomach were essentially normal. She had had no further hemorrhage in the two months following operation.

The spleen was described by Dr. M. J. Schlesinger.

Gross Description.—The spleen weighed 118 Gm. Near the middle of the lateral surface near the lower pole, the capsule was rough, nodular and yellowish white over an area about 1 cm. in diameter; section here revealed a small pyramidal infarct extending less than 0.5 cm. into the spleen. Elsewhere the capsule was smooth, glistening and translucent. The spleen was uniformly brownish red both externally and on the cut surface. Little blood oozed from the cut surface, and no pulp could be scraped away on the knife. The spleen was firm but not actually rubbery. The trabeculae were easily made out, but no broad fibrosed bands could be seen anywhere. The corpuscles were prominent, uniformly distributed and rose slightly above the cut surface. Thin sections were easily cut and maintained their shape well.

Microscopic Description.—Several sections were stained with eosinomethylene blue and Mallory's aniline blue stain, after Zenker fixation. They showed a definite increase of fibrous tissue in the pulp. This was also evident as an increase in thickness and prominence of the trabeculae. Throughout the pulp, in the walls of the venules, there was a uniform but discontinuous network of collagen fibers. This fibrosis was not present in the corpuscles which were numerous, large and active and had large germinal centers, usually showing several mitotic figures. No areas of necroses were present in any of the corpuscles. Throughout the pulp were found a scattering of eosinophilic polymorphonuclear leukocytes and eosinophilic myelocytes, but no islands of myeloblastic cells were present. Nucleated red blood cells or other cells of the erythroblastic series were not present. Only scattered neutrophilic polymorphonuclear leukocytes were found in the pulp. No other abnormal cells and no hemosiderin or other pigment were present. There was no unusual congestion of the spleen.

The section from the infarcted area presented a typical sharply circumscribed infarct with some hemorrhage about it and a serofibrinous exudate into and about it. There was slightly increased condensation of the fibrous tissue about the infarct. The capsule over the infarct was intact, and there was no exudate on it. The capsule throughout was not noticeably thickened.

CASE 4.—*History.*—A girl, aged 2, was brought to the Children's Hospital for bleeding from the stomach. There was no history of hemophilia or diseases of the blood in the family and no known exposure to tuberculosis. She had had measles, pertussis, chickenpox and bronchitis. The mother said that she had always been pale and occasionally had had a nosebleed. The day before entry, she complained of pain in the epigastrium, and vomited a large amount of dark, clotted blood. On admission, she was pale and irritable. There were two purpuric spots on the anterior surface of the left leg. The spleen was palpable 3 cm. below the costal margin. Examination of the blood showed: hemoglobin, 35 per cent; red cells, 1,160,000, and leukocytes, 6,000, and the smear was not characteristic of any disease of the blood. The bleeding and clotting time were normal, as were also the icteric index and the fragility test as well as the Wassermann and tuberculin tests. The gastro-intestinal roentgenograms were negative. The platelet count was 100,000. The child had no subsequent bleeding for the following six weeks, during which time the spleen enlarged to 7 cm. below the costal margin. She then began to pass tarry stools, and her spleen decreased slightly in size. Because of the fear of another serious hemorrhage, it was thought wise to remove the

spleen. This was done by Dr. W. E. Ladd. At operation, a large, firm, nodular spleen was found bound to the stomach at its upper pole by firm adhesions which bled easily and in which there were a few large veins. No thrombosis of the portal or splenic vein, or nothing causing pressure on the splenic vein could be demonstrated. She had had no further hemorrhage during the month following operation.

The spleen was described by Dr. Schlesinger.

Gross Description.—The spleen weighed 185 Gm. It resembled that of case 3 in color and consistency, but no infarct was present. The capsule, however, differed in that, instead of being smooth, the surface of the spleen had an irregular contour composed of an intimate mixture of irregularly shaped areas, none more than a few millimeters in diameter, which were alternately depressed and elevated. The differences in height were never more than about a millimeter. On the cut surface, the trabeculae were prominent, and some could be seen to pass inward from the small depressions on the surface.

Microscopic Description.—Several sections were stained with eosinmethylene blue and with Mallory's aniline blue. Except for the absence of the infarct, these sections closely resembled those from case 3. The fibrosis of the pulp was slightly more marked here, but still maintained its diffuse characteristics. Also, the number of eosinophilic myelocytes was slightly larger.

Case 5 (Private Record).—*History.*—A boy, aged 7, was seen because of a gastric hemorrhage. The father had tuberculosis, but there was no history of chronic or acute disease of the blood in the family. The boy had measles one year previously but seemed normal until at the age of 5 years, he suddenly, without preceding symptoms, vomited a large amount of dark and bright blood. In six weeks, he was apparently well and had no further complaint, until one year later when he again vomited blood. At this time, the spleen was found to be enlarged. He was seen six months later. The results of the examination were negative except for a large spleen, extending to the umbilicus and well into the left flank. Examiation of the blood showed a hemoglobin of 80 per cent, a red cell count of 5,296,000, and leukocytes, 6,000. A blood smear was normal, except for 11 per cent of eosinophils. Platelets were normal. The bleeding time was normal, and the clotting time was slightly prolonged. The Wassermann test was negative. The roentgenograms of the chest and gastro-intestinal tract were negative. The fragility of the red cells was normal. Splenectomy was advised and performed by Dr. Beth Vincent. At operation, the spleen was readily removed, and no interference with the splenic or portal circulation was demonstrated. The patient remained free from symptoms until thirteen months later, when a third slight hemorrhage occurred following a severe physical strain. He had had no hemorrhages in the past two years. The results of the examination of the blood was negative, except for the persistence of a high percentage of eosinophils.

The spleen was described by Dr. Schlesinger.

Microscopic Description.—The three sections available were stained with hematoxylin and eosin. The spleen showed a more marked fibrosis than the spleens in the foregoing two cases, but again the condition was almost entirely confined to the pulp. The number and size of the trabeculae was not greatly increased, but the walls of the venules were definitely thick, and the venules stood wide open, even when empty of blood. Only occasional venules showed this characteristic in the other two cases. The capsule was not included in these sections. The corpuscles were numerous and active and again had hyperplastic

germinal centers. No cells of the erythroblastic or myeloblastic series were found. Otherwise, the sections resembled those in case 1.

The other cases, except Wallgren's, are as follows:

Moschowitz[3] reports a boy who had repeated hemorrhages. The stomach was explored for an ulcer, but none was found. The spleen was noted as being 1.5 cm. below the ribs, but apparently no importance was attached to this. In all respects, this case was similar to the others in this group. The last observation was that the boy left the hospital in good condition.

Parsons[4] reports a girl, aged 8, with a typical history of repeated hemorrhages and enlarged spleen. The condition was diagnosed as Banti's disease, but the patient did not present any leukopenia. Splenectomy was done. The liver was normal at operation, with a small amount of free fluid in the peritoneal cavity.

Parsons reports a girl, aged 2½, with a typical history of repeated hemorrhages, in whom the liver as well as the spleen was palpable, and some free fluid was present in the peritoneal cavity. Splenectomy was done. The liver and the splenic vein were normal.

In discussion of a similar case, Peyton reports a boy who died from sudden hemorrhage while in the hospital under observation. Bleeding in this case was found to come from the rupture of a vein of the esophagus. No cirrhosis of the liver was noted. No thrombosis of the splenic vein could be found.

Byfield[5] reports a boy, aged 6, whose condition was diagnosed as splenic anemia. At operation, thrombosis of the splenic vein was not found, and seven months after the operation, the blood was normal and there was no recurrence of the hemorrhage.

Pfeiffer[6] reports an adult, aged 20, whose case was followed from the first hemorrhage at 11 years of age and who had made no progress toward Banti's disease. The blood, however, did show some leukopenia and a marked secondary anemia.

COMMENT

The explanation for this symptom-complex is not entirely clear, but it seems to us that probably it depends on some condition that causes obstruction to the splenic vein. It is recognized that it might possibly be due to disturbance that was primary in the spleen itself. This hypothesis, however, does not lend itself to analysis as readily as the theory of venous obstruction. Wallgren, in discussing his cases and those which he found in the literature, is in accord with this view. Obstruction to venous return from the spleen may result from sclerosis of the vessel walls accompanying phlebitis; from the retraction of adhesions about the vein following a plastic peritonitis; from some

3. Moschowitz, Alexis V.: Massive Bleeding from the Stomach Without Demonstrable Lesion, Am. J. M. Sc. **152**:714 (Nov.) 1915.

4. Parsons, Leonard G.: Proc. Roy. Soc. Med., Section on Diseases of Children **19**:27, 1926.

5. Byfield, A. F.: Diagnosis of Splenomegaly with Hematemesis, M. Clin. N. Amer. **8**:681 (Sept.) 1924.

6. Pfeiffer, Damon B.: Recurrent Hematemesis Due to Splenic Anemia, Appendicitis and Cholethiasis, Ann. Surg. **85**:290 (Feb.) 1927.

abnormality of the vessels, or from pressure on the vein from without by some condition other than adhesions. In order to compensate for the impediment to the splenic venous flow, there is an enlargement of the normal gastric veins, and a collateral circulation is also established in the adhesions which form between the spleen and the stomach or the spleen and the lower border of the diaphragm. When any of these distended vessels rupture, vomiting of blood occurs. The engorged spleen is emptied of its contained blood through this outlet and is reduced in size. Spontaneous cure of these children can be explained by the reestablishment of cannulation in the thrombosed vein or relief of the obstruction. Splenectomy is beneficial because it removes the organ demanding a large amount of blood, the return of which causes congestion in all the connecting veins. With the circulatory demand no longer present, the enlarged veins tend to return to normal size and their distention disappears.

That thrombosis of the portal vein may occur secondary to infection in some other part of the body and that an enlargement of the spleen and gastric hemorrhage may result from this condition are well recognized. One of us [7] reported such a case with the observations at autopsy at a previous meeting of this society. Other cases are also mentioned by Wallgren and are found frequently in the literature. Wallgren believes that the thrombophlebitis of the splenic vein with an enlarged spleen may be present for a long time before a hemorrhage develops. He cites two cases in which he suggests that the thrombosis was dependent on an infection of the umbilicus at birth. One of our children gave a history of severe umbilical infection; another had tonsillitis five months before the hemorrhage. In two of our children, the spleen was known to have been enlarged two years before the first hemorrhage occurred.

All of the cases studied by Wallgren that came to autopsy showed some obstruction to the splenic vein sufficient to have produced congestion of the spleen. In two instances, this obstruction was caused by adhesions constricting the vein from without. In several instances thrombosis was found; in others, the lumen was nearly occluded by calcareous placques—in one instance, the lumen was only 3 mm. in diameter. In the children in whom splenectomy was done no change in the portal or splenic veins was observed at operation, but this is not conclusive evidence that no changes were present, because it is almost impossible to explore the venous and portal system completely under these conditions. Engorgement of the vessels was found, however, and adhesions that bled freely were present, attaching the spleen either to the diaphragm or to the stomach.

7. Smith, Richard M.: A Case of Portal Thrombosis, Tr. Am. Pediat. Soc. **37**:415 (July) 1920.

The examination of the spleens removed at operation in our three cases, in Wallgren's cases and in his case that came to autopsy showed the same or similar conditions. The changes from the normal consist essentially of a diffuse fibrosis with some alteration in the spleen itself indicating an increase in the activity of the hematopoietic tissues, toward the side of the formation of white cells. This picture is consistent with chronic passive congestion. When first removed from the body, the spleen is firm and hard and bleeds freely from a cut surface. The size is greatly reduced with the escape of blood. Its behavior in these respects is not different from that of a normal spleen treated in a similar manner.

Most of the children presenting the symptom-complex which we have described have been reported as having either splenic anemia or Banti's disease, although they present some differences from the usual picture in this disease. In Banti's disease, gastric hemorrhage is usually a late occurrence and is also preceded by a period of general malaise. As a rule, it occurs in individuals older than those reported in this group. Leukopenia is a striking characteristic of Banti's disease and is supposed to be found constantly, but such may not always be the case. It was not present in our cases. In Banti's disease, the liver is involved as well as the spleen, and ascites is present. Several of the cases of this group showed a small amount of ascites which was transient in character, but in none of them was there any cirrhosis of the liver. Enlargement of the liver and ascites should have appeared in some of these children if they were to progress in the usual course of Banti's disease. Brahm's patient died thirty-seven years after the first hemorrhage. This case came to autopsy, and the liver was normal. Pfeiffer's patient was seen eleven years after the first hemorrhage. Alvarez observed his patient for seven years. Hart had a case in which hemorrhage occurred during the twelfth and the twenty-first year. Gruber's cases were fatal thirteen and fourteen years, respectively, after the first hemorrhage. In all of them, the liver was normal.

The decrease in the size of the spleen after hemorrhage and its subsequent increase in size were striking in our two recent cases and are recorded in connection with many of the case reports collected by Wallgren. This is not characteristic of Banti's disease so far as we have been able to discover from the literature or from the reports of those who have seen a considerable number of cases of this disease. In the literature of thrombophlebitis of the splenic vein, it is, however, clearly stated to be a frequent phenomenon. The spleen is one of the large reservoirs of blood in the body. When hemorrhage occurs, this reservoir is drained and fills again only with the gradual restoration of a normal volume of blood.

Most of the articles on Banti's disease do not recognize that thrombophlebitis of the splenic and portal vein is one of the essential features of the disease and that it was so stated by Banti in his original communication. In his early group of cases, Osler failed to emphasize this point and most of the English and American reports make no mention of it. Warthin [8] says that "portal and splenic thrombosis, splenic tumor and hematemesis, splenic anemia, and Banti's disease . . . all represent the same thing . . . an infective thrombophlebitis. The intermittent character of the process is dependent upon changes in the lumen of the obliterated and stenosed vein." Lyon,[9] in his article on diseases of the spleen in Osler's "System of Medicine," says that thrombosis of the splenic vein presents a "clinical picture identical with that of splenic anemia."

If splenic anemia, Banti's disease and thrombophlebitis of the splenic vein are all the same pathologic process, it is possible that the group which we are discussing is only a particular manifestation of the same condition. The question might well be raised, however, whether this group of cases does not present a symptom-complex distinct enough to be considered a separate entity. The points of difference which have been noted between this group and the larger group seem to us to warrant careful consideration. Byfield says in connection with his case that "we do not feel that we have offered a complete diagnosis;" Parsons says that "we have a definite form of splenomegaly in childhood of unknown etiology which should in the present state of our knowledge be called Banti's disease," and Poynton [10] says, in discussing a similar case, that he was "not prepared to say that a case of this kind was necessarily one of Banti's disease or would eventually become one."

TREATMENT

Immediately following a hemorrhage, transfusion is indicated. The question then arises whether the spleen should be removed? Our answer at present is yes.

In the twenty-six cases whose records we have studied, splenectomy was done in eleven. Ten of the patients are alive and well at the last report. One died of hemorrhage immediately after the operation. We cannot say that further hemorrhages will not occur after splenectomy, because none of these children have been followed for a sufficient length

8. Warthin: Relation of Thrombophlebitis of Portal and Splenic Veins to Splenic Anaemia and Banti's Diseases, Internat. Clin. **4**:189, 1910.

9. Lyon, I. P., in Osler and McCrae: Modern Medicine, ed. 2, Philadelphia, Lea & Febiger, 1915, p. 934.

10. Poynton, F. J.: Proc. Roy. Soc. Med., Section on Diseases of Children **19**:33, 1926.

of time. One of our patients and one of Wallgren's were operated on two years ago. In Banti's disease, however, hemorrhage does not often occur after the spleen has been removed.

Nine patients in this group on whom splenectomy had not been done died of hemorrhage. Some died suddenly, after they had remained free from hemorrhage for a long time. In one case, the fatal hemorrhage did not occur until thirty-seven years and in another sixteen years after the first bleeding. In many instances, the interval has been several years. A sudden fatal hemorrhage may occur at any time. Poynton refers to a child who died from hemorrhage while under observation in the hospital. In one of our cases, it was impossible to control the bleeding before operation, but it stopped after the spleen was removed.

Six of the patients in whom no splenectomy was done are alive. Alvarez reports one of his children who had her first hemorrhage at the age of 3 as "pale and anemic" at the age of 10. One of our patients has not had a hemorrhage for four years and is in good condition. Moschowitz's patient was discharged from the hospital in 1915. It would be interesting to know her subsequent history.

In conclusion, we would say that there is a definite form of splenomegaly in childhood in which gastric hemorrhage occurs early without previous symptoms of disease. The size of the spleen is reduced following hemorrhage but soon becomes large again. There may be long periods of remission from bleeding followed by a sudden hemorrhage which may prove fatal. The condition apparently does not progress to the typical picture of Banti's disease. The etiology of this condition is best explained on the basis of obstruction to the splenic vein, which produces chronic passive congestion of the spleen and distention of the gastric and esophageal veins, and in the veins in the adhesions between the spleen and the stomach or diaphragm. Thrombophlebitis of the splenic vein is an important cause of venous obstruction. Splenectomy offers a means of controlling the hemorrhage and, so far as our observations go, of effecting a cure of the disease.

66 Commonwealth Avenue.

ACUTE PHOSPHORUS POISONING

REPORT OF A CASE WITH RECOVERY *

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Marked hepatic enlargement, severe jaundice, hematemesis, melena, and coma in phosphorus poisoning usually point to a fatal outcome. A case is reported in which the patient recovered after presenting these manifestations.

REPORT OF CASE

History.—C. O., a boy, aged 16 months, was referred to Dr. Frederic H. Bartlett at the Babies' Hospital on July 31, 1924, on account of vomiting for four days and unconsciousness for three hours.

The patient was an only child of healthy parents. He had never been ill and was rather above the average in his mental and physical development. On July 25, six days before admission to the hospital, he had been found playing with a box of roach paste known to contain 0.5 per cent yellow phosphorus. While it was not definitely known that he swallowed any of it, medical advice was sought the next day because of regurgitation after meals. After examination, the physician ascribed the symptom to a digestive upset caused by hot weather and difficult dentition and was of the opinion that it was not related to possible phosphorus poisoning. On the following day, July 27, regurgitation after meals persisted, and there was slight loss of appetite. On the 28th the patient vomited a little, was cross and irritable and slept more than usual. The day before admission he vomited again, and there was increasing drowsiness for the thirty hours preceding admission, with practically complete loss of appetite. On the day of admission, he vomited about half a cupful of dark-brown material resembling prune juice when he was awakened at 10 a. m.; this alarmed the parents, and they brought him to the hospital. There had been no fever, no change in the stools and no convulsions.

When first examined in the hospital, the infant was comatose and showed jaundice, an enlarged, firm liver extending 7 cm. below the ensiform cartilage and 5.5 cm. below the costal margin in the midclavicular line, hematemesis, dark urine and normal temperature. He weighed 12,885 Gm. (28 pounds, 5½ ounces). The stomach and lower bowel were irrigated, and in the return from both the guaiac test was positive. The urine gave an acid reaction, contained a small amount of albumin and gave negative tests for sugar, acetone and diacetic acid. The blood contained 85 per cent hemoglobin (Dare), 4,400,000 erythrocytes and 7,700 leukocytes, of which 72 per cent were polymorphonuclears.

After lavage, 3 per cent glucose solution was offered by mouth in small amounts, but was vomited. All oral administrations were then withheld for a period of fifty hours. The patient was given a transfusion of 140 cc. of whole blood from the father by the direct method, and in addition about 70 cc. of 3 per cent glucose solution in normal solution of physiologic sodium chloride

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* From the Babies' Hospital and Department of Diseases of Children, College of Physicians and Surgeons, Columbia University.

was introduced into the blood stream. Hypodermoclyses were given from four to six hours apart, using 3 per cent glucose in normal solution of physiologic sodium chloride during the first twenty-four hours, and 6 per cent glucose during the second twenty-four hours, so that the patient received on these respective days 1,500 cc. of water with 63 Gm. of glucose and 1,200 cc. of water with 72 Gm. of glucose. Subcutaneous administrations were continued to the sixth day in the hospital, in gradually diminishing amounts as the child's clinical condition improved. The attempt to give glucose by rectum gave rise to a troublesome degree of distention and was promptly abandoned. Water given by mouth on the third day in the hospital did not cause vomiting, and thereafter fluids were forced by this route, between 555 and 1,530 cc. being given each day. The first food offered by mouth was fat-free lactic acid (cultured) milk and cereal, in small quantities, on the sixth day in the hospital; and from then on the diet was gradually increased up to the routine "soft diet" for well children of his age.

The patient remained in the hospital for fifteen days. The temperature, which was normal on admission, rose to 102.4 F. on the morning of the second day, and during the ensuing three days it fluctuated between 99 and 101.4 F.,

TABLE 1.—*Urinalyses*

Date	24-Hour Amount	Color	Reaction	Specific Gravity	Albumin	Sugar	Acetone	Diacetic Acid	Bile	Guaiac	Microscopic
7/31	.....	Dark	Acid	.....	+	0	0	0	..	..	Calcium oxalate and uric acid cystals
8/ 2	.....	Amber	Acid	.....	0	+	0	0	+	0	Negative
8/ 3	.....	Amber	Acid	.....	0	0	0	..	0	..	Negative
8/ 5	330 cc.	Amber	Acid	1.019	0	0	0	0	0	0	Urates
8/ 8	.....	Straw	Acid	1.008	0	0	0	..	..	..	Negative

Nitrogen partition, Aug. 5:			
	Total nitrogen	1.95 Gm.	
	Urea Nitrogen	1.27 Gm.	65 per ent
	Ammonia nitrogen	0.605 Gm.	31 per cent
	Urea	2.74 Gm.	
	Uric acid	0.210 Gm.	

returning to normal thereafter. Whether this mild pyrexia forms part of the symptom complex of his condition or whether it resulted from treatment, is impossible to say definitely. There was no vomiting after the first day. Diarrhea set in on the seventh day in the hospital, but was not troublesome, responding promptly to protein milk therapy. The mental response and disposition of the patient did not become normal until the sixth day in the hospital. Jaundice was perceptible up to the time of discharge, although the test for bile pigments in the urine became negative on the third day. The liver increased in size during the first three days of observation, reaching a maximum measurement of 10 cm. below the ensiform and 5 cm. below the costal margin in the midclavicular line. It thereafter receded and became less firm to palpation, except during the eleventh and twelfth days when, coincident with an infection of the subcutaneous tissue of the back at the site of a hypodermoclysis, it temporarily enlarged again. At the time of discharge the edge of the liver was about two fingerbreadths below the costal margin. He lost 2,360 Gm. (5 pounds 3 ounces) during the fifteen days in the hospital.

Results of the urinalyses are given in detail in table 1.

The first sample of blood drawn for chemical analysis was taken two hours after the first hypodermoclysis of 300 cc. of 3 per cent glucose-saline solution. This and subsequent blood tests are reported in table 2.

The child was last seen when he was 3½ years old, twenty-eight months after poisoning. He had not been seriously ill since leaving the hospital, had had no digestive difficulties and had led the normal life of a child of his age. He weighed 36 pounds 9 ounces (18 Kg.) and measured 39¾ inches (101 cm.) in height. He had twenty teeth, all in good condition. The liver was palpable half an inch (1.27 cm.) below the costal margin, the edge being of normal contour and consistency. The spleen was not palpable.

COMMENT

The diagnosis of acute phosphorus poisoning was made on the history and clinical picture. In an attempt to recover metallic phosphorus, a liter of urine was collected on the fifth and sixth days following admission and sent to a chemical laboratory which specialized in medicolegal analyses. The classic test [1] depends on a phosphorescence of the distillate when the specimen is heated in a retort or in a flask with

TABLE 2.—*Analyses of Blood*

Date		Blood Sugar, in Mg. per 100 Cc.[1]	Urea Nitrogen in Mg. per 100 Cc.[2]	Inorganic Phosphorus in Mg. per 100 Cc.[3]	Plasma Chlorides in Mg. per 100 Cc.[4]	CO_2 Combining Power by Volume [5]	Icteric Index [6]
7/31		25	22.0	3.4	638	52.0	30
8/ 1	12:15 P.M.	48	....	...	...	....	..
	1:45 P.M.	Clysis, 300 cc. 6 per cent glucose					
	4:15 P.M.	150	....	...	...	....	..
	6:15 P.M.	148	....	...	...	....	..
8/ 2		130	....	...	...	....	..
8/ 4		90	55.0	...	475	46.7	30
8/ 8		83	11.7	...	500	59.8	30
8/12		96	10.1	...	513	....	15

1. Myers-Bailey modification of Lewis-Benedict method, J. Biol. Chem. **24**: 147, 1916.
2. Myers, V. C.: Practical Chemical Analysis of Blood, ed. II, Mosby & Co., St. Louis.
3. Benedict, S. R., and Theis, R. D.: J. Biol. Chem. **61**: 63, 1924.
4. Myers and Short: J. Biol. Chem. **44**: 47, 1920.
5. Van Slyke, D. D.: J. Biol. Chem. **30**: 289, 1917.
6. Bernheim, A. R.: J. A. M. A. **82**: 291, 1924.

a condenser. The result of this test was negative. A more delicate test, but one which is more apt to give false positive results, consists in reducing the test material with nascent hydrogen, passing the generated stream of hydrogen gas and phosphuretted hydrogen into a solution of silver nitrate and obtaining a precipitate of reduced silver. The reaction to this test was reported positive. Such part of the ingested phosphorus as has already been oxidized is lost [2] among the phosphates normally present in the blood, urine and stools, its quantity being too small to effect any detectable fluctuation, at any rate without controls. In view of the fact that ingestion of the poison, according to the history, occurred not later than six days before admission, no attempt was made

1. Holland, J. W., in Peterson, F.; Haines, W. S., and Webster, R. W.: Legal Medicine and Toxicology, ed. 2, vol. 2, Philadelphia, W. B. Saunders Company, 1923.

2. Spinner, J. R.: Zum Problem der Phosphorvergiftung, Deutsche med. Wchnschr. **45**:912 (Aug. 14) 1919.

to recover phosphorus from the washings of the gastro-intestinal tract; it did not appear open to question that the metallic phosphorus had by that time been either expelled or absorbed. It is conceivable that earlier collection of urine for analysis might have yielded a more convincing positive test, but in view of the critical condition of the patient certain sacrifices in biochemical interest were necessary.

While the behavior of fatal cases of phosphorus poisoning has made the clinical picture familiar,[3] the biochemistry—particularly the blood changes—has received relatively little attention. In spite of considerable experimental work on nitrogen metabolism, the alteration of the level of the blood sugar, which was a striking abnormality in the case here reported, has been to a great extent ignored. The work of Frank and Isaac [4] on phosphorus poisoning in rabbits revealed a fall in the level of the blood sugar and a disturbance of the mechanism regulating the blood sugar comparable to those found in the present case. Desqueyroux,[5] besides showing a similar hypoglycemia, reported a rise in blood urea. Marshall and Rowntree [6] discovered a decreased tolerance for galactose and levulose in dogs poisoned by phosphorus; but the absence of figures on the blood sugar from their reports leads one to infer that their conclusions were based on the observation of renal excretion of these carbohydrates rather than on studies of the blood. Williamson and Mann,[7] in an attempt to produce selective liver damage in dogs by chemical poisoning, administered phosphorus in lethal doses, but were unable thereby to obtain uniform lowering of blood sugar comparable to the infallible effect of hepatectomy. Out of eight animals so treated, only three showed a fall in the level of the blood sugar, of moderate degree and unaccompanied by the clinical picture of hypoglycemic reaction. Bodansky,[8] using poorly nourished dogs and dogs previously subjected to sublethal doses of phosphorus, obtained more uniform

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3. Stacy, W. C.: Dangers of Phosphorus in Fireworks, Correspondence, J. A. M. A. **77**:1514 (Nov. 5) 1921. Corwin, A. S.: New York State J. Med. **22**: 475 (Oct.) 1922. Dwyer, H. L., and Helwig, F. C.: Phosphorus Poisoning in Child from Ingestion of Fireworks, J. A. M. A. **84**: 1254 (April 25) 1925.

4. Frank, E., and Isaac, S.: Ueber Wesen des gestörten Stoffwechsels bei der Phosphorvergiftung, Arch. f. exper. Path. u. Pharmakol. **64**:274, 1911.

5. Desqueyroux, J.: Recherches expérimentales sur les troubles des échanges azotés dans l'intoxication phosphorée aiguë, Rev. de méd. **39**:616, 1922.

6. Marshall, E. K., Jr., and Rowntree, L. G.: Studies in Liver and Kidney Function in Experimental Phosphorus and Chloroform Poisoning, J. Exper. Med. **22**:333, 1915.

7. Williamson, C. S., and Mann, F. C.: Studies on the Physiology of the Liver: V. The Hepatic Factor in Chloroform and Phosphorus Poisoning, Am. J. Physiol. **65**:267 (July) 1923.

8. Bodansky, M.: The Production of Hypoglycemia in Experimental Derangements of the Liver, Am. J. Physiol. **66**:375, 1923.

results and quotes a terminal blood sugar of 35 mg. per hundred cubic centimeters accompanied by symptoms of hypoglycemic shock. He also [9] demonstrated a diminished tolerance for levulose by observing the reducing substances in the blood following administration of phosphorus, which he submitted as chemical evidence of loss or diminution of function in the liver. I have been unable to discover any reported studies of blood chemistry in acute phosphorus poisoning in man.

At least two factors combined to bring about a hypoglycemia in this patient: (1) starvation and (2) a specific liver effect based on destruction or loss of function of liver tissue. The temporary depression of blood sugar resulting from starvation in young children has been abundantly demonstrated.[10] Figures showing from 30 to 38 mg. per hundred cubic centimeters have been obtained in infants and young children. The small amount was apparently due to starvation alone, and both American and German authors have offered the general statement that hypoglycemia occurs early, and is more marked, the younger the subject. From the inconsistency of reported results, however, one must suspect that the equation is not a simple one of two variables, age and length of fast, but that at least one further factor is operative. Rumpf [11] reported his most marked instance of hypoglycemia after a twenty-eight-hour fast in a marantic infant, a subject in whom a profound metabolic disturbance already existed. Joseph [12] singled out certain patients, prone to attacks of vomiting and convulsions, in whom an extraordinary individual lability of the blood sugar in response to fasting is present. The fact that such patients form a distinct clinical group adds evidence of the importance of this third unknown; indeed, it is precisely in describing this group that time-honored terms such as "biliousness" and "torpid liver" were formerly so frequently used, and the clinician of today, armed with more accurate functional tests, may well accept the challenge implied in these expressions to prove or disprove the rôle played herein by altered liver function. The point to be emphasized in the present case, however, is this: that if the interpretation of the behavior

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9. Bodansky, M.: The Effect of Chloroform and Phosphorus Poisoning on Carbohydrate Tolerance, J. Biol. Chem. **58**:515 (Dec.) 1923.

10. Shaw, E. B., and Moriarty, Margaret: Hypoglycemia and Acidosis in Fasting Children with Idiopathic Epilepsy, Am. J. Dis. Child. **28**:553 (Nov.) 1924. Hoeffel, G., and Moriarty, Margaret: The Effect of Fasting on the Metabolism of Epileptic Children, Am. J. Dis. Child. **28**:16 (July) 1924. Talbot, F. B.; Shaw, E. B., and Moriarty, Margaret: Hypoglycemia and Acidosis, J. A. M. A. **83**:91 (July 12) 1924. Rumpf, F.: Ueber den Blutzucker im Hunger und über die glykämische Reaktion nach kleinen Dosen Zucker beim Säugling und Kleinkinde, Jahrb. f. Kinderh. **105**:321, 1924. Josephs, H.: Fasting as a Cause of Convulsions, Am. J. Dis. Child. **31**:169 (Feb.) 1926.

11. Footnote 10, fourth reference.

12. Footnote 10, fifth reference.

of blood sugar in response to fasting is correct the low level of 25 mg. per hundred cubic centimeters would not have been reached as the result of starvation alone, but requires additional explanation.

It is well known that when the portal blood is shunted directly into the inferior vena cava without passing through the liver, as in experimental animals subjected to an Eck fistula, a rapid fall in blood sugar occurs. Important corroborative evidence of the part which the liver plays in maintenance of the level of the blood sugar was adduced by Mann and Magath [13] and Mann [14] who obtained a progressing fall in blood sugar following total extirpation of the liver in dogs. It is not to be supposed that the liver is the only tissue damaged by ingestion of yellow phosphorus; yet there is ample morphologic evidence that in fatal cases at least it is profoundly affected, and chemical evidence of its injury has previously been afforded by the development of jaundice, increase in nonprotein nitrogen and urea nitrogen in the blood, increase in output of urinary nitrogen with alteration in its partition, the occasional appearance in the urine of amino-acids characteristic of destruction of liver cells, and the alteration in fat and glycogen content of the liver post mortem. It would therefore be logical to attribute the hypoglycemia in the present case to starvation in the presence of a disturbance of the function of the liver brought about by metallic phosphorus. The results of experimental work in this field have already been referred to.

At the time the patient in the case described first came under observation, his critical condition called for immediate therapeutic measures, and the scheme of treatment instituted was based on the nearest clinical analogy, acute yellow atrophy, in which hypoglycemia has been reported.[15] The low blood sugar value obtained, 25 mg. per hundred cubic centimeters, seems therefore the more remarkable in that the blood was taken two hours after hypodermic administration of glucose; and it is at least conceivable that at some time it was even lower. Judging from the behavior of adults in whom the blood sugar has suddenly been lowered by an overdose of insulin, one might expect convulsions to

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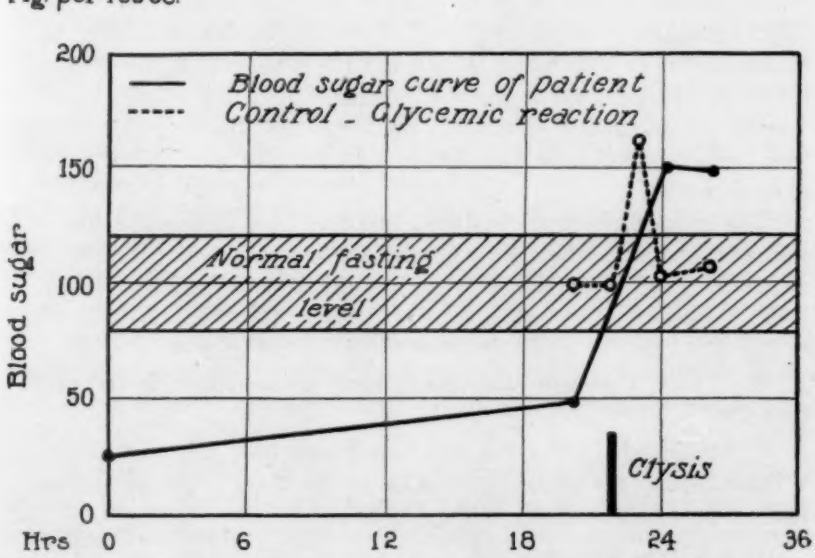
13. Mann, F. C., and Magath, T. B.: Studies on the Physiology of the Liver: II. The Liver as a Regulator of the Glucose Concentration of the Blood, Am. J. Physiol. **55**:285, 1921.

14. Mann, F. C.: Studies on the Physiology of the Liver: I. Technic and General Effects of Removal, Am. J. M. Sc. **161**:37, 1921; Studies on the Physiology of the Liver: II. The Effect of the Removal of the Liver on the Blood Sugar Level, Arch. Int. Med. **30**:73, 1922.

15. Wells, H. Gideon: Chemical Pathology, ed. 4, Philadelphia, W. B. Saunders Company, 1920, p. 555. The treatment of acute phosphorus poisoning, shortly after ingestion, by oral administration of large amounts of mineral oil had not then been recommended (footnote 3, third reference). Owing to the long interval of six days after ingestion, the efficacy of this measure in the present case would be questionable.

occur. This was not the case, however, and possibly results from an inherent difference in response of young children to low levels of blood sugar, as suggested by the reports of Tisdall and his associates.[16]

Both in hepatectomized experimental animals and in patients in whom the blood sugar has been depleted by starvation, the relief afforded by the parenteral administration of glucose is prompt and striking with such symptoms as muscular weakness and faintness. In the case here reported, this was a noteworthy feature of the clinical course. Following the first hypodermoclysis there was a sudden



Level of the blood sugar after six-hour fast and after administration of glucose.

improvement in the patient's general condition: he brightened, seemed stronger and became aware of his surroundings; then, after some minutes, relapsed into his toxic state. His response to the first hypodermoclysis was especially dramatic; later on, the effect was less pronounced. The studies of the blood of August 1 (see chart), showing the level of blood sugar after a six-hour fast (including the withholding of subcutaneous administrations), and at intervals after hypodermic administration of 18 Gm. of glucose, present a striking deviation from the normal curve. Not only does this suggest damage to the liver, but in fact a disturbance of the entire carbohydrate-regulating mechanism.

16. Tisdall, F. F.; Brown, A.; Drake, T. G. H., and Cody, M. G.: Insulin in the Treatment of Malnourished Infants, Am. J. Dis. Child. **30**:10 (July) 1925.

Similar alterations of glucose tolerance, with abnormally high and prolonged rise in blood sugar curves after administration of glucose, have been demonstrated by Tisdall and his associates in infants with intestinal intoxication, diarrhea or parenteral infections [17] and in puppies under a variety of influences [18] and cannot be considered to be limited to instances of phosphorus poisoning.

The high level of blood urea nitrogen occurring at a time when the liver had just begun to diminish in size is noteworthy, as well as the output and partition of urinary nitrogen on the fifth day in the hospital when the nitrogen intake had been zero since admission.

No attempt was made in the study of this case to estimate fat metabolism separately; yet the high level of carbon dioxide combining power on admission as well as on subsequent observations, in spite of low initial blood sugar and a probable depletion of carbohydrate reserve, is worthy of mention. Wells [19] commented on the decrease in acetone-body production in Eck fistula dogs and the part which the liver plays in acidosis.

The examinations of the blood reported give chemical evidence of the recovery of function with progressing convalescence; the return of sugar, urea and chlorides to normal and the drop in the icteric index.

SUMMARY

1. A case of severe acute phosphorus poisoning, with recovery, is described.

2. Studies of the blood in this case demonstrate a hypoglycemia and a ditsurbance in the mechanism regulating the blood sugar, attributable at least in part to the effects of the poison.

135 East Fifty-Fifth Street.

17. Tisdall, F. F.; Drake, T. G. H., and Brown, A.: Studies on the Carbohydrate Metabolism of Infants, J. Lab. & Clin. Med. **10**:704, 1924-1925; The Carbohydrate Metabolism of Infants with Diarrhea, Infections, and Acute Intestinal Intoxication, Am. J. Dis. Child. **30**:837 (Dec.) 1925.

18. Tisdall, F. F.; Drake, T. G. H., and Brown, A.: The Production of a Lowered Carbohydrate Tolerance in Dogs, Am. J. Dis. Child. **32**:854 (Dec.) 1926.

19. Wells, H. Gideon: Chemical Pathology, ed. 4, Philadelphia, W. B. Saunders Company, 1920, p. 563.

URETERAL STRICTURE AND CHRONIC PYELITIS IN CHILDREN*

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BALTIMORE

Imperfect drainage is usually the basic cause of chronic pyelitis in the adult. I have not seen a sufficient number of cases in children to warrant a similar dogmatic statement. By far the most common cause of renal urinary stasis in adults is ureteral stricture. In most of the infants and children I have treated for chronic pyelitis, ureteral obstruction has been present, and the usual tests by urogram and wax bulb have led me to interpret the obstruction as due to ureteral stricture. At any rate, I have found that establishment of urinary drainage by dilatation of the narrow ureteral area has resulted in a high percentage of cures in children as well as in adults.

Apparently, up to the present time, the concensus among general practitioners and pediatricians has been that for children with chronic pyelitis there is no therapy beyond medicinal and dietary measures, or in extreme cases a resort to surgery. Several of my younger patients had been submitted to vaccination treatments, in addition to the usual medical and dietary measures, before they came into my hands, but so far I have not seen vaccination prove effectual in adults or in children.

Many pediatricians have based their treatment of chronic pyelitis in children on the supposition that the condition is secondary to gastro-intestinal disturbances. It is certainly true that in adults ureteral stricture with urinary stasis, whether the urine is infected or not, is frequently accompanied by gastro-intestinal symptoms. These vary from the simpler complaints of anorexia and accumulations of gas to the more serious manifestations of nausea and vomiting, attacks of diarrhea, or a chronic mucous colitis. Not infrequently, an acute attack of renal colic is accompanied by such severe abdominal pain and gastro-intestinal disturbances as to lead to a needless operation for a supposed attack of gallstone colic, intestinal obstruction, or acute appendicitis. However, the question still remains: Which is the primary condition?

In view of the fact that the urologist has found that in many of these children as well as in adults the intestinal disturbances clear up as

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soon as effectual renal drainage has been established, their plea to the pediatrician is that in the presence of definite symptoms referable to the urinary tract, he should not limit his treatment too long to the gastro-intestinal disorder.

EXTENT OF RENAL INVOLVEMENT

Controversy concerning the extent of involvement by these chronic infections has given rise to the use of a variety of terms to describe the condition. Some authors, holding that the infection always implicates both the pelvis and the kidney substance, prefer the term pyelonephritis. Helmholz,[1] whose careful clinical work in children has been of great value, concludes that "clinically it is impossible to differentiate the different forms involving the kidney cortex, pelvis, ureter, and bladder, singly or together." His studies [2] of pathologic material derived from experimental work on rabbits speaks for both the systemic and the reflux methods of infection—the infections that come through the circulation involving the cortex, medulla, pyramids and pelvic mucosa. Those supposedly due to direct extension from the bladder also occasionally involve all parts of the kidney, but show a decided predilection for the walls of the pelvis and the peripelvic fat.

My clinical studies on infections of the urinary tract associated with ureteral stricture present strong evidence for the view that most of the chronic infections of the upper urinary tract are located in the renal pelvis, and may be classed as pyelitis or infected hydronephrosis.

In support of this view is my personal experience which has been that 80 per cent of patients suffering from ureteral stricture and varying degrees of stasis and dilatation in the upper tract have not had any infection in the urine or any history pointing to a previous infection, whereas only 20 per cent have had an infected urine. Secondly, in those with urinary infection the pus disappears promptly and the urine becomes sterile after dilation of the ureteral stricture and establishment of good drainage, without the use of drugs by mouth or by local lavage.

In those whose pyelitis does not clear promptly after dilatation of the original area of stricture in the lower ureter, one can usually find an explanation on physical grounds: (1) the area of stricture persists in narrowing, owing to repeated irritation from some distant focus of infection, and eradication of this focus results in permanent drainage and cure of the pyelitis; (2) pyelography may show, in addition to the original stricture usually located in the lower pelvic ureter, an area of narrowing at or near the pelviureteral junction. This may represent an

1. Helmholz, H. F.: Modes of Infection in Pyelitis, Am. J. Dis. Child. **22**:606, (Dec.) 1921.

2. Helmholz, H. F.: The Pathologic Changes in Experimental Ascending and Hematogenous Pyelitis, J. Urol. **8**:301, 1922.

unusual density of the normal physiologic narrowing at the pelviureteral junction, but more often it is pathologic, and represents an infiltration due to direct extension from the inflamed pelvis; or the thickening may be due to infiltration of the perinephric or periureteral tissues. If the surgeon places the dilating bulb near the tip of the roentgen-ray catheter and makes certain by touch and, if necessary, by urogram that he is passing bulbs of increasing size all the way over into the renal pelvis, he will be able to establish adequate drainage with a resulting cure of the pyelitis in some of these cases; (3) urographic studies and pelvic mensuration may show an unusually large pelvis, which from its increased weight or from other factors has caused descensus of the kidney and interference with good drainage. The release of perirenal and periureteral adhesions, wide dilation of the pelviureteral stricture, if present, resection of the enlarged pelvis in suitable cases, and high fixation of the kidney have in some of these cases resulted in adequate drainage and prompt clearing up of the pyelitis. In this class of cases, however, too much operating is being done on the strength of the urographic appearance. One result of stricture in the lower ureter is dilatation of the upper portion, and this dilatation affects the long axis as well as the transverse diameter of the tube and leads to redundancy and the so-called ureteral kinks. Unfortunately, in too many cases these urographic "kinks" are still interpreted as the cause of the hydronephrosis and the impaired drainage, with the result that many useless nephropexies are performed. Without operation, many of these patients improve rapidly in general health and take on fat after dilation of the original lower stricture, so that the prolapsed kidney is spontaneously replaced to a degree normal enough to induce good drainage and a clearing of the infection.

ETIOLOGY OF THE STRICTURE

So far as my experience in chronic pyelitis in children goes, I have found that in a high percentage (nearly 100 per cent) ureteral stricture was also present. What, then, are the etiologic factors in ureteral stricture of early life?

It has been my belief, purely from clinical observation, that in adults ureteral stricture usually results from a blood stream infection derived from a distant focus.

One might naturally think that stricture giving rise to symptoms in early life would most likely be of congenital origin, and yet, on going over the clinical records of such cases, one is struck by the practically constant association of some distant focus of infection. I am aware that an association of two disease conditions in the same individual is not proof of a casual relationship, particularly when one is dealing with two diseases of frequent occurrence like tonsillitis and ureteral stricture.

In adults, I have often made the therapeutic test of ignoring a manifest focus of infection, such as tonsillitis, dental abscess, or sinusitis, until I could determine the permanence of results obtained by repeated dilations of the ureteral stricture alone. As a rule, I have found that, so long as their focal infection persists, such patients continue to return for repeated ureteral dilatations, whereas after the focus has been removed, a few more ureteral dilatations produce a permanent effect and the symptoms cease.

The age at which serious results from ureteral stricture first manifest themselves is no criterion as to the duration of the stricture.

A ureteral stricture may begin insidiously in early life and in the course of years gradually may produce renal injury, which may not cause serious symptoms until relatively late in life when they then appear to be of recent origin.

In such cases and in the cases of ureteral stricture found in childhood and associated with renal infection—calculus, hydronephrosis or other conditions commonly associated with stricture in adults—shall one say that the stricture, because of its incidence in early childhood, is of congenital origin? My clinical observations have led me to classify most of them as due to some distant focus of infection. Some recent work, however, not yet in print, would indicate that I have laid too much stress on the rôle of focal infections in the etiology of the formation of stricture and have not given sufficient credit to the factor of congenital malformations.

Sponsored by Dr. Edwin Beer, of New York, Dr. Martin Schreiber last year visited Germany and at the Senkenberg Pathological Institute of the Medical School of the University of Frankfurt was granted the privilege of following 100 consecutive unselected autopsies for a detailed study of the urinary tract. His material comprised forty-two adult males, aged from 22 to 87; thirty-seven adult females, aged from 20 to 81; twenty-one children, from the seventh month prenatal to 15 years of age. In brief, Schreiber found an incidence of 12 per cent of lesions that would correspond to the present conception of ureteral stricture, i. e., a thickening of the ureteral wall sufficient to cause a dilatation of the tract above it, which might have been demonstrated in vivo by urogram, and which would have caused a hang of the bulb if this test had been used.

Schreiber [3] divides his twelve cases into "5 showing so-called congenital accentuated narrowing of physiological narrow sites; 2 as kink obstruction due to crossing anatomical structures, the vas deferens in one case and the uterine artery in one; 1 as due to external pressure of

3. Personal communication to the author.

a massive adnexal tumor; and 4 as caused by definite inflammatory processes involving the ureteral wall."

Schreiber concludes from this monumental piece of work at the autopsy table that one does not need to invoke focal infections as responsible for ureteral inflammations. Nevertheless, those who have had a wide experience in this field will await with interest his conclusions after he has had some years of clinical study on ureteral strictures in living patients.

ACUTE CYSTITIS AND CHRONIC PYELITIS

Does acute cystitis lead to an acute pyelitis which becomes chronic? I think this may be the sequence in some cases, but it is probable that in most instances of this character there has previously existed an area of moderate narrowing in the ureter.

An acute pyelitis is often preceded by symptoms of an acute cystitis of a few days' duration. In the past, the interpretation of such a case has been that the pyelitis was primary but the cystitis has happened to give rise to symptoms first, to be followed in a few days by the fever and chills, pain in the loin, and the classic symptoms of acute pyelitis. It is probable that in such cases the cystitis may represent the primary infection, and that the infiltration and edema of the bladder walls cause, temporarily, a partial closure of the ureteral os, with secondary stasis of urine in the upper tract. This static urine easily becomes infected by any one of the usual routes and a pyelitis supervenes. If the ureteral channel has previously been normal, the kidney drainage is usually reestablished as soon as the acute cystitis has run its course or received proper treatment, and the infection in the kidney subsides synchronously with that of the bladder.

If there is continued stasis in the kidney due to a previously existing malposition, or if perinephritic or periureteral bands or adhesions have developed during the acute attack, or, as is probably more often the case, if there has previously existed a latent ureteral stricture with stasis, the acute pyelitis may become chronic and may persist until the ureteral channel is adequately opened.

RENAL LAVAGE

Those who have written on the advantages of renal catheterization in treating chronic pyelitis in children have attributed the good results obtained to the particular solution used in the renal lavage. Formerly, I shared this enthusiasm, but since recognizing the part that ureteral stricture plays in most chronic infections of the kidney, I question whether the former results were due to the antiseptic solutions used and not more to the better drainage established by the use of the renal catheter. In recent years, I have not used pelvic lavage either in adults

or in children and certainly get more prompt results with increasing dilation than were formerly obtained by lavage supplemented only by the incidental dilation afforded by the plain catheter.

DORMANT URINARY INFECTION

There is a fairly prevalent tradition that a pyelitis in later life comes on because of a latent infection which has persisted in the urinary tract after an acute pyelitis (which may have been undiagnosed or forgotten) occurring in infancy. This theory is probably most often used to explain a pyelitis during pregnancy, it being supposed that the tissue changes of the urinary tract, or pressure conditious due to the pregnancy, are sufficient to revive a long dormant childhood infection.

Those familiar with the life history of ureteral stricture can offer a better explanation for these infections arising in later life. Ureteral stricture, whether congenital or acquired, may exist throughout a natural life without giving rise to urinary infection or to serious symptoms.

Acute pyelitis often clears spontaneously, probably because there is no enduring factor of stasis in the urinary stream. Acute pyelitis showing a tendency to recurrence should arouse suspicions of the existence of some degree of chronic stasis which is intermittently accentuated.

One often sees patients with a chronic pyelitis who give a history of having had similar prolonged attacks in the past, and in whom normal sterile urine was obtained between the attacks, but in whom on examination one can demonstrate the presence of ureteral stricture. Some authors hold that these are examples of recurrent pyelitis which has led to damage of the ureteral wall and subsequent formation of stricture.

My experience leads me to believe that, in most cases, stricture is the original lesion leading to the stasis and finally to secondary infection of the urine. Under favorable circumstances, the inflammatory reaction in the ureteral stricture area may so far subside as again to allow drainage efficient enough to enable the kidney to wash out the infection. In later months or years, there may occur another disturbance in the stricture area with inflammation, edema and another closure of the lumen sufficient to exaggerate the stasis and trap the micro-organisms coming through the kidney, thus giving rise to another attack of pyelitis.

Some of the conditions which apparently may bring about such a sequence of events are as follows: (*a*) The stirring up of a distant area of focal infection, in the tonsils, teeth, sinuses, intestinal tract, or a carbuncle, onychia, or even an ingrowing toenail; (*b*) the premenstrual or menstrual congestion; (*c*) the tissue changes or pressure incident to a pregnancy; (*d*) appendicitis, probably causing a local peritonitis, which spreads to the area of the ureteral stricture; (*e*) traumatic conditions. The disturbance of the tissues about the ureteral stricture by an

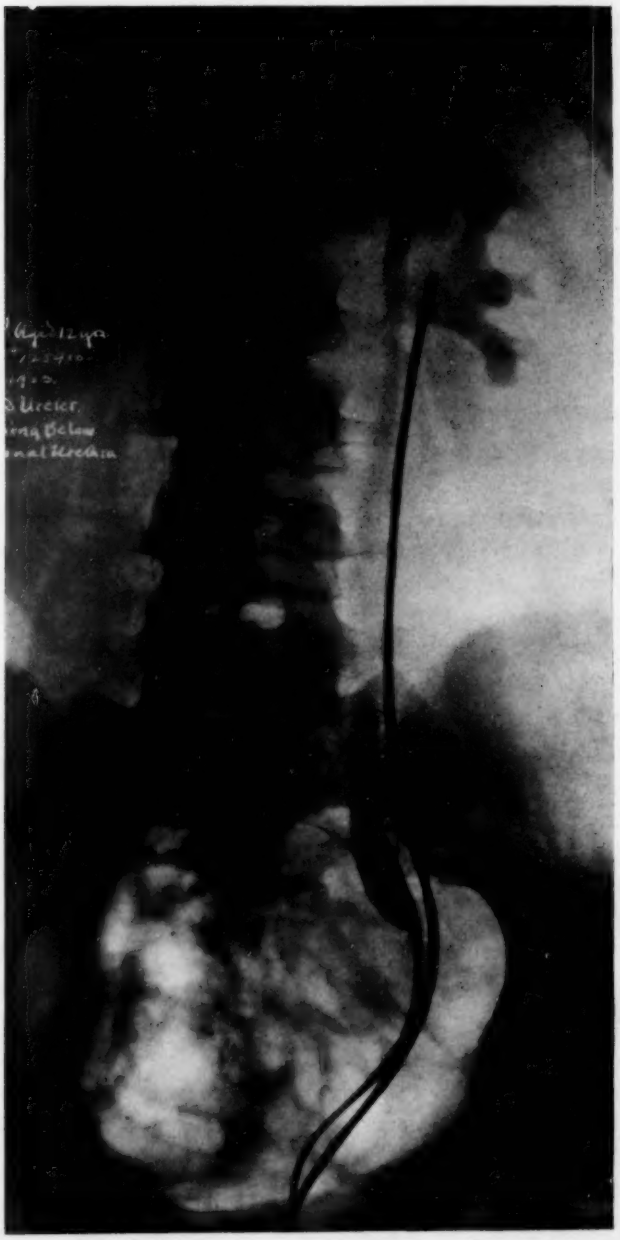

Fig. 1.—Appearance in a girl, aged 12, of duplication of the left urinary tract. The ureter from the upper pelvis opens externally beneath the urethra, giving rise to incontinence since birth.

operation or by childbirth frequently gives rise to postoperative or to puerperal pyelitis. In such instances, the lowered vitality of the patient and an increase of micro-organisms in the blood stream are probably additional factors leading to the development of the pyelitis. Of medicolegal interest are the instances of pyelitis developing immediately after a severe strain or contusion experienced in a railroad, streetcar or automobile accident. If stricture is found in such cases, a careful history sometimes reveals that the patient has had a backache, pain in the pelvis or bladder symptoms before the accident. A prolonged rough automobile trip is sometimes followed by an acute pyelitis, and in such instances one often elicits the added history that the patient became chilled and was carrying an overfull bladder.

SUMMARY OF CASES OF URETERAL STRICTURE IN CHILDREN

In the present paper, I have in mind thirty-four cases of renal involvement in children. The list is limited to patients of 15 years of age or younger, and is rendered still smaller by considering only those patients in whom symptoms in the urinary tract began before the onset of menstruation. In children, as in adults, any discussion of the usual so-called surgical diseases of the kidney must include a consideration of ureteral stricture.

Pyonephrosis.—One case of pyonephrosis in a boy, aged 4 years, the only male in my series, was associated with bilateral ureteral stricture and slight dilatation on the opposite side, which was free from infection.

Hydronephrosis.—Six cases of hydronephrosis, in which the kidney held 10 cc. or more of urine, were all associated with stricture. In some of these the urine was infected and these are put into the pyelitis group. One child, aged 11 years, with a right kidney having a capacity of about 30 cc., had been submitted to a left nephrectomy when she was 7 years old, because of intermittent Dietl's crises since the age of 3.

Hematuria.—Three children with severe hematuria were all found to have ureteral stricture.

Congenital Malformation.—In one case of congenital malformation in a girl of 12, there was a double left kidney with a double ureter, the ureter that drained the upper kidney opening in the vestibule just beneath the external urethral orifice. This accessory ureter showed congenital valve formation and wide dilatation above this point (figs. 1, 2 and 3). The right ureter was found to give a slight obstruction to the bulb and have a widened upper ureter and a kidney pelvis holding 10 cc. (fig. 4).

Renal Calculus.—In one of two cases of renal calculus, a child, aged 2 years and 9 months, with bilateral calculus, had bilateral stricture

with widely dilated ureters above the strictures. The second patient, a girl, aged 7 years, had bilateral stricture with bilateral hydronephrosis and formation of calculus in the right pelvis.

Tuberculosis.—I have always excluded tuberculosis of the urinary tract in my discussions of ureteral stricture, because of the specificity

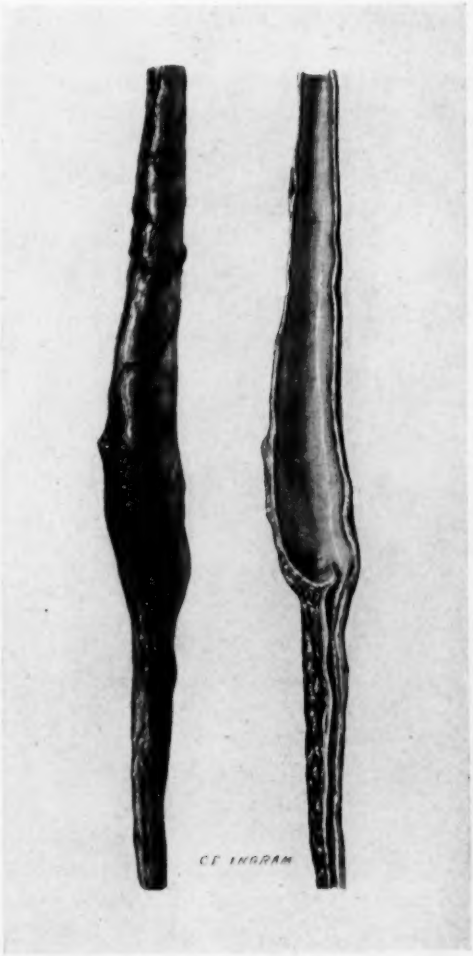

Fig. 2.—Excised portion of accessory ureter seen in figure 1, showing congenital valve formation and dilatation above.

of the condition and because of the fact that strictures and obstructions due to tuberculous thickening of the ureteral walls are secondary to the disease in the kidney. Recent observations force the question whether simple stricture with its urinary stasis ever creates a lowered resistance favoring a tuberculous invasion of the kidney. I have had fourteen

patients, who have had one tuberculous kidney removed and who returned at varying periods because of pain in the opposite kidney. In two of these there was found a reflux of urine from the bladder to the remaining kidney, apparently due to a scar tissue distortion of the ureterovesical region, with urinary reflux and dilatation of the ureter and kidney pelvis. In the other twelve patients, the pain in the remaining kidney was apparently due to simple stricture, and relief followed proper dilatation.

I have seen four cases of renal tuberculosis in children aged, respectively, 14, 13, 11 and 11 years. The patient, who had undergone a right nephrectomy at 14, returned five years later with severe pain of six months' duration in the left kidney. She belongs in the list mentioned above of patients who returned after a nephrectomy with symptoms due to stricture on the opposite side. Although she was said never to have

Fig. 3.—Section from congenital valve shown in figs. 1 and 2.

had tonsillitis, there was an area in her upper right tonsil which suggested a small retention abscess, and during the year of dilatations of the ureteral stricture she developed a severe quinsy.

I diagnosed tuberculosis of the right kidney in one of the children when she was 11, the severe bladder symptoms and presumably the tuberculous lesion having been present since the age of 5 years. Operation was advised, but the patient was not seen again until she was 20. A mere shell of kidney parenchyma was then found distended with a tuberculous pyonephrosis.

The other child, aged 11, recently was submitted to a right nephrectomy for tuberculosis, and the preliminary examinations revealed what appeared to be a simple stricture of the left ureter with slight dilatation above (fig. 5). Had this stricture not been discovered and dilated, this patient in all probability would have returned later with symptoms in the remaining kidney.

Chronic Pyelitis.—My list of twelve cases of chronic pyelitis in children includes, with one exception, only those patients who had pyelitis at the time of treatment, as shown by the presence of pus and a culture from the kidney. The one exception is case 4. In the acute attacks this patient's urine at times showed albumin, casts, leukocytes and erythrocytes, but always remained negative to culture. I include this case because in each of the attacks the temperature chart and the

Fig. 4.—Slightly dilated right kidney and upper ureter in case represented by figs. 1, 2 and 3.

physical signs and symptoms were typical of an acute pyelitis, the urine at times being normal and at times suggesting an inflammation of the kidney without infection. I have seen several similar cases in adults in which, seemingly, stasis from the ureteral stricture was causing all the signs and symptoms of a pyelitis except the presence of infection in the urine. Such cases are common after an area of stricture has been disturbed by dilation, and throw an interesting light on the formerly mysterious "ureteral chill."

This list could have been increased in number if those children who came with symptoms due to stricture, and presenting normal urine, but who had a well authenticated history of previous attacks of pyelitis had been included. The twelve patients with chronic pyelitis ranged in age from 6 to 14 years, the average age on admission being 11 years.

The duration of renal symptoms varied from six months to nine years, the average in the twelve cases being four years.

The right kidney was infected in eleven cases and the left kidney in nine cases, bilateral ureteral stricture being demonstrated in all but one.

The infecting agent was found to be *B. coli* in ten, *B. mesentericus* in one, and staphylococcus in one.

The treatment in six of the earlier cases was dilation of the stricture and pelvic lavage with 1:1,000 silver nitrate solution, and in the last six cases with dilation only. Those treated with dilation only cleared up as promptly as did those with the addition of renal lavage. The average number of treatments was three on the right side and four on the left. In two cases, the infection cleared up after the first treatment and in seven cases after the second treatment. The high average of three and four treatments was due to two cases in which the infection is still present and to a third patient (case 7), who had, as complications, chorea and a marked mitral lesion. This girl, aged 12, was the only one in whom ureteral stricture was not demonstrated. She needed six treatments on each side with pelvic lavage before the infection was cleared up. One of the two patients (case 5), who still presents a colonic infection, never had any symptoms referable to the urinary tract. She was admitted to the hospital at 12 for removal of her tonsils, and the urine was found to have a heavy content of albumin, pus and colon bacilli. Investigation revealed bilateral ureteral stricture with bilateral colon bacillus pyelitis. Because of the absence of symptoms, it was difficult to get the parents to realize the necessity for treatment, but the ureter was dilated seven times on each side during a period of three years. Albumin was reduced to a mere trace and the amount of pus markedly reduced. Several microscopic examinations for tubercle bacilli and a test made on a guinea-pig were negative. The other child (case 9), who still carries a colon bacillus infection, had ten dilations on the right and nine on the left, with apparent complete restoration to health following four years of invalidism from recurring pyelitis. Her urine soon became free from pus, and I ascribe the persistence of the bacilluria to high strictures in the abdominal ureter, which were discovered only in late urograms (fig. 6). These upper strictures had been missed by the bulbs located 10 cm. back of the catheter tip and had therefore

received only such dilation as that afforded by the plain catheter, which was evidently insufficient to establish perfect drainage and a complete clearing of the infection.

All of these patients have been heard from during the preparation of this paper and all are in good health, including the two who still carry an infection. The time that has elapsed since the last treatment varies from one to ten years, with an average of four and one-half years.

Several of the patients who were promptly relieved of the infection have returned months or years later to have renewed ureteral dilation because of recurrent symptoms. In none of these had the stasis reached a point that would induce reinfection of the urine.

Fig. 5.—Right nephrectomy for tuberculosis. Stricture of the left ureter located just below the pelvic brim should be noted. The urine from the left kidney was normal. Necrosis of the right hip joint should be noted.

REPORT OF CASES

CASE 1.—V. H., a girl, aged 11, was admitted to the Johns Hopkins Hospital, Feb. 23, 1916. In June, 1911, at the age of 6, she had the first attack of pain in the right side with chills and a temperature of from 104 to 105° F. Several days later, a similar attack of colicky pain in the left side, with renewal of the chills and high temperature, occurred. The blood was tested for typhoid and malaria. After three weeks, the patient was taken to a health resort, and had no further trouble until September, 1912, when she suffered what was thought to be an attack of appendicitis. For the past four years these seizures had recurred two or three times a year, usually in winter. All attacks had been accompanied by symptoms of bladder trouble. Removal of the tonsils one year previously had been followed by markedly improved health. The onset of the last

attack occurred, February 10, thirteen days previously. The pain was not so severe as in the former attacks, but was accompanied by chilly sensations and a temperature of 104 F. The attack began in the region of the right kidney, and within a week it shifted to the left side. There had not been any fever for the past three days. The urine showed a trace of albumin, many leukocytes and an occasional erythrocyte, and culture yielded a colon bacillus. On catheterization with small bulbs, obstruction was demonstrated on both sides, with pyuria and colon bacillus on culture. Urograms revealed slight dilation of the pelves, with considerable widening of the calices, and dilation of the ureters down to the areas of the stricture. The urine was negative for leukocytes and on culture after two dilations on each side.

A third dilation was given on each side, and because of the patient's marasmic condition it was advised that she remain out of school until fall. She gained so rapidly, however, that she soon returned to school. She was not seen again for five years. While she was in a preparatory school, routine examinations of the urine repeatedly showed albumin. When sent to me in May, 1921, she seemed to be in excellent health and was large and strong for her age. There were no symptoms. The urine was negative, except for the albumin. A 14 French bulb was used on each side, showing dense areas of stricture. A letter from Dr. Foy Roberson, of Durham, N. C., Nov. 16, 1926, says that the patient is now a senior at college and has no symptoms of any kind. The urine had been free from albumin since the last dilation, but there had been no recent examination.

CASE 2.—E. J., a girl, aged 13, was admitted to the Church Home and Infirmary, July 30, 1918, with a history of symptoms of bladder trouble since 5 years of age. At 8 she was operated on for appendicitis, and one year later for postoperative hernia. She continued to have much frequency and burning, having to void every one or two hours at night. For several years, there were attacks of pain in the kidney regions, and recently these attacks have occurred every week or two, being especially bad on the left side. Examination disclosed tenderness over the kidney regions and on pressure over the ureters at the pelvic brim. Urinalysis revealed pus and bacteria. Ureteral investigation showed bilateral stricture with an infection of the left kidney with the colon bacillus. After two dilations of each side, the urine was normal. Enlarged infected tonsils were removed after the patient returned home, and Dec. 3, 1926, Dr. H. G. Camper, of Welch, West Virginia, wrote that she had remained well in every way.

CASE 3.—M. A. D., a girl, aged 8, was admitted to the Johns Hopkins Hospital, Feb. 24, 1919. In the spring of 1915, at the age of 4, she had a mild attack of scarlet fever from which she convalesced slowly, and her father, a physician, in watching the urine for albumin found considerable pus. Dr. Steele of Yale diagnosed pyelitis because of the urinalysis and the persistence of fever. There was never any pain or tenderness pointing to involvement of the kidneys. The patient was placed on potassium citrate and sodium bicarbonate every three hours until the urine became alkaline. The temperature soon became normal, and the urine was said to be normal. There have been three acute returns of the trouble in the urinary tract, each one lasting about two weeks. In August, 1918, after bathing in the ocean and becoming chilled, the patient developed a fever of 105 F. For the past four or five weeks, she had been having intermittent attacks of fever and the urine at times had shown one-eighth volume of pus, with considerable albumin. There had not been any complaint of pain or soreness, and the child never looked particularly ill. On examination, neither kidney

was palpable, and no special tenderness was present over the region of the kidney or over the ureters at the pelvic brim. Urine catheterized from the bladder was opalescent and contained many leukyocytes and rod bacilli, and a nitric acid ring of 5 mm. depth of albumin. Ureteral stricture was demonstrated on both sides, and there was a bilateral colon bacillus pyelitis. After three dilations on the right side and two on the left to an 11 French bulb, the specimen of urine from the bladder was normal.

A letter written, Nov. 21, 1926, says that the patient is now in the Senior High School and is considered "an exceptionally healthy girl".

CASE 4.—J. C., a girl, aged 12, was admitted to the hospital, Aug. 21, 1922, with a history of scarlet fever at 4 years of age, followed by bladder frequency with both diurnal and nocturnal incontinence. The tonsils had always given trouble; the right tonsil was large, red and cryptic. The present attack started on the morning of admission, with a chill and pain in the region of the right posterior flank. The temperature was 103.3 F. Neither kidney was palpable; extreme tenderness was present over the region of the right kidney; tenderness, with a desire to void on pressure over either ureter at the region of the pelvic brim, was felt. The following day, the temperature was 99.4 F.; the leukocytes numbered 10,000, with a normal percentage of polymorphonuclears. The urine was free from pus and was normal on culture.

The ureters were investigated, August 23 and 25, stricture being found on both sides. On August 28, the tonsils and adenoids were removed.

The patient returned in May, 1925, having been well until January of that year, when she again began to have pain in the region of the right kidney and later in the left. Frequency and incontinence had also returned. Again the urine was found normal. During May and June, the patient had three dilations of each ureter up to a 15 French bulb, after which she was free from pain and symptoms of involvement of the bladder until January, 1926. I saw her again in April, 1926, seven weeks after she had been operated on for appendicitis. She reported having the same old pains, and said that these had become so severe that she sometimes had to walk the floor at night. Incontinence had returned. Catheterized urine showed a trace of albumin and many leukocytes and erythrocytes, but the culture was negative. After two dilations on the right side and one on the left during April, improvement was so marked that treatment was discontinued.

On May 24, Dr. Gichner telephoned that the patient was having an attack of pyelitis on the right side, with a temperature of 104 F. The urine contained an occasional leukocyte and a few casts, negative to culture. During May and June, dilation of the areas of stricture was again carried up to a 15 French bulb, and since then the symptoms have been quiescent.

CASE 5.—F. C., a girl, aged 12, was admitted to the Hospital for the Women of Maryland, Jan. 9, 1922. She was a large, apparently healthy child, with no complaints, but was referred by Dr. Harry Adler because of albumin, pus and bacteria in the urine. This was discovered in the course of routine examination during an attack of bronchitis. Dr. Adler then investigated the records at the Hebrew Hospital, where she had had a tonsillectomy a few months previously. The hospital records revealed a similar urinalysis. An account of the treatment and results is given in this paper under the section on chronic pyelitis.

CASE 6.—M. C., a girl, aged 6, was admitted to Church Home and Infirmary, June 12, 1924. In May, 1923, her mother had noticed that the child was voiding from fifteen to twenty times a day and frequently at night. Incontinence soon developed and persisted as day and night enuresis for from four to five months.

At times, the patient had a high temperature and became nervous, with twitching of the hands and head. She had medical treatment all summer, and in the fall the urine cleared. The weight increased, and her health seemed good all winter.

In February, 1924, her teacher reported that the child seemed languid; she apparently was better in March and April. On May 15, the mother noticed blood in the urine. This lasted for one week without other symptoms; then frequency returned, followed by nocturnal and diurnal incontinence, with occasional chilly sensations and a temperature of nearly 100 F. Three weeks previously, there was right kidney colic during one night. Pus had been found with each examination during the past three weeks.

The case was diagnosed as bilateral ureteral stricture, with bilateral colon bacillus pyelitis. Investigation of the left side was followed by an acute flare-up of a typical pyelitis, with a temperature of 104 F., the symptoms subsiding completely in one week. Dr. Slack then removed the diseased tonsils. On the second treatment of each side with a bulb of 11 French size, the urine was found normal as to pus and culture. The child was dismissed as well one month after admission. On Dec. 17, 1926, Dr. Nathan Dykes of Columbus, Ga., reported that the patient had had one or two attacks of frequency, pus in the urine and a slight temperature for a few months after returning home, but that she had been perfectly well for eighteen months and that the urine was normal.

CASE 7.—M. L. B., a girl, aged 12, was admitted to Johns Hopkins Hospital, June 9, 1920, with a history of diphtheria at 2 years of age; she had never been well since. She had had "ptomaine poisoning" at 4 years, followed by attacks of "gastritis", lasting several days with high temperature, nausea and bladder frequency. In August, 1918, the patient had "malaria", with arthritis of the knees and hips; this was followed by chorea. Another attack of chorea, in November, 1919, followed the "malaria". The attacks of "gastritis" occurred about every six weeks during the period from 4 to 6 years of age; since that time, they had occurred less often, until the spring before admission, when a series of three attacks developed, accompanied by much bladder trouble. The patient had suffered with bladder frequency for several years; pain had not been present. The tonsils were removed in 1918.

Examination showed a fairly well developed girl; the heart was somewhat enlarged, with a definite, well compensated lesion of the mitral valve. The diagnosis was bilateral colon bacillus pyelitis. Each kidney pelvis was given three treatments with lavage with 1:1,000 silver nitrate solution. There was no evidence of stricture with bulbs up to 13 French. The patient was referred for further treatment to Dr. J. N. Baker of Montgomery, Ala., who continued the lavage therapy. After three additional treatments on each side, the urine was normal. Dr. Baker reported in November, 1926, that the patient had had a severe attack of influenza in February, 1921, with a decided involvement of the heart, but with no apparent damage to the kidneys. "Her present general health is better than I ever thought it would be. There is a slight mitral murmur. The urine remains normal".

CASE 8.—D. K., a girl, aged 11, was admitted to the Church Home and Infirmary, May 16, 1925. She was large and well nourished, and was suffering with a colon bacillus pyelitis of the right kidney, the present attack having persisted since March 19, a period of two months. She had had a similar attack four years previously, when colon bacilli and pus were present in a specimen of urine from the bladder. A plain roentgenogram at that time was negative for stone. Since the first attack she had not had pain up to the onset of the second seizure, but she had had many spells of bladder urgency, with occasional incon-

tinence. At times she wet the bed two or three nights a week; then she might have an interval of two or three weeks without bed-wetting.

The recent attack began with abdominal pain, headache, temperature of 104 F., and light nose bleed. The Widal test made nine days after the onset of the attack was negative for typhoid. The patient had been in bed for two months; the temperature had been normal at intervals during the past two weeks. The temperature the day before admission was 100.3 F., normal on admission, rising to 100 F., after the first treatment of the right side. Bilateral stricture was demonstrated; urine from the left kidney was normal. Two dilations were given on the

Fig. 6 (case 9).—Bilateral colon bacillus pyelitis of four years' duration, showing dense area of stricture just below the pelvic brim with slight dilatation of the tract above, holding 11 cc. The narrow area just below the pelvis should be noted. A bulb placed near the catheter tip demonstrated infiltration of this area.

right with a 14 French bulb and one on the left with a 9 French bulb. The patient was dismissed, May 30, with normal urine. She had had tonsillitis at the age of 6 and again at 8 years, and removal of the enlarged tonsils was recommended. This was done soon after she left the hospital, and a report from her physician, Dr. Mary Willis, Nov. 26, 1926, says that the child has continued in good health.

Case 9.—H. K., a girl, aged 14, was admitted to the Church Home and Infirmary, Oct. 1, 1924. For the past four years the patient had suffered from recurrent attacks of pyelitis characterized by chills and fever, great pros-

tration, bladder frequency, and much pus in the urine. There had always been at least a trace of albumin and sometimes casts, even between the attacks. Only in recent attacks had she complained of pain in the kidney region. First, seizures with chills and fever occurred as often as two times a week. Later, they came at intervals of two or three months and were thought to be of intestinal origin. Any unusual exertion tended to precipitate an attack, so the child had been allowed to do little in the past four years. The last onset occurred, September 2, on return from a picnic, although she had been well protected and was not conscious of being chilled. That night she was taken with chills, and the temperature rose to 104. The patient was the daughter of a physician and had had many forms of medication. The summer before admission she was given increasing doses of an autogenous vaccine.

On admission, the patient was free from fever and had no complaint. The tonsils were embedded; their surfaces were irregular and cryptic. There was slight enlargement of the lymph glands at the angles of the jaws. The history was negative as to tonsillitis. Several carious teeth were noted. The left kidney could not be palpated, and no tenderness was present in this region. The right kidney was easily palpated and caught below the costal margin on deep inspiration; it was apparently normal in size and consistency, and was not tender. Some tenderness was felt over each ureter as it crossed the pelvic brim. The urine contained a fair trace of albumin, much pus and many rod bacilli. A specimen from both kidneys showed pus and yielded a pure culture of *B. coli*. The first kidney investigation was done under ether anesthesia. The bladder revealed bullous edema over the trigonum and base, and this inflammatory swelling surrounded both ureteral orifices. The right ureter took a no. 7 renal catheter with spiral wax tip and wax bulb for a distance of only 3 or 4 cm. A metal searcher with curved end entered only 4 cm. A whalebone filiform was teased entirely through the area of obstruction, but a second and third filiform entered beside the first only for a distance of about 4 cm. At the next examination, three weeks later, under local procaine hydrochloride anesthesia, a no. 6 renal catheter with carefully prepared spiral wax tip went through the stricture area, but the 10 French bulb with long sloping shoulders failed to go beyond the obstruction. At the third effort three weeks later, a no. 9 French bulb went through the stricture (fig. 6). The left ureter showed a dense stricture, but no special difficulties were encountered in getting through at each treatment. An account of the treatments and final results is given in the comment on case 9 under the section on chronic pyelitis.

CASE 10.—N. M., a girl, aged 11, was admitted to the Church Home and Infirmary, Nov. 9, 1923. The mother stated that the child had been well and strong until May, six months previously, when she had been taken suddenly ill with headache and high temperature. Her physician considered this due to a digestive disturbance and administered a cathartic, after which she vomited. No chill was present. The temperature remained high the following day, and examination of the urine revealed pus. The patient remained in bed one week because of this attack. Various urinary antiseptics had been used, but the urine had never been entirely clear. Cultures showed a staphylococcus and colon bacillus, and vaccines made from these were used without success. In August, the family went to the North Carolina mountains, where the child was normally active in games and swimming. On the journey homeward, she developed a sore throat and immediately had to be put to bed for a week, with an attack similar to the first one; much pus was present in the urine. Since then, she had gained

in weight and seemed perfectly well except for the presence of constant pus and a trace of albumin in the urine.

The mother says that at 4 or 5 years of age the patient had a prolonged spell of bladder trouble, voiding frequently at night and still more frequently in the day; no enuresis had been present. She had had several attacks of tonsillitis, and it had been planned to have the tonsils removed the past summer, but the onset of the renal trouble prevented.

Examination disclosed large cryptic and inflamed tonsils. There was no complaint of tenderness on palpation along the urinary tract. The urine showed a trace of albumin, a few leukocytes and many bacilli. Culture from the bladder showed a gram-negative coccus and *B. coli*. These two organisms were also grown from the right kidney, urine from the left kidney yielding only the colon bacillus. The diagnosis was bilateral stricture. After two dilations of the right

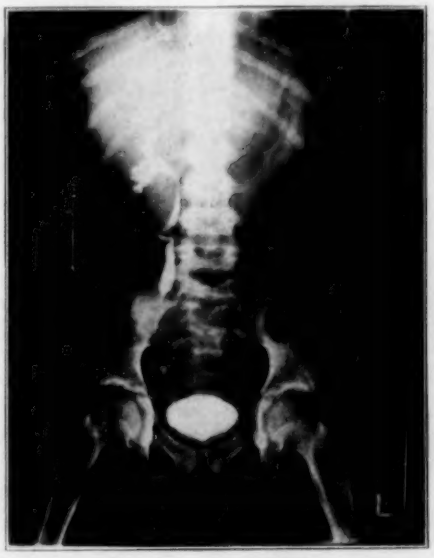

Fig. 7 (case 11).—Bilateral stricture, recurring pyelitis of the right side of two years' duration. The area of stricture is hidden by the shadow of the bladder, slight dilatation of the tract above holding 12 cc.

ureter and one of the left ureter, the urine was normal. Three dilations were done on each side, and the tonsils were removed soon after she returned home. A report of Dec. 3, 1926, says that the child is in excellent health and that the urine is normal.

Case 11.—M. W., a girl, aged 12, was admitted to the Johns Hopkins Hospital, Oct. 19, 1923. About two years previously, the patient had had an attack of pain in the lower right quadrant, with swelling of the abdomen; the condition was diagnosed as appendicitis. She had had many spells of dull pain in the lower right quadrant since then. One month before admission, the pain became acute and was accompanied by fever, nausea and vomiting. Two days before admission, the patient had a similar acute seizure; no constipation, dysuria or hematuria were present. On admission the temperature was 103.6 F.; the pulse, 110 and respirations, 24. The systolic blood pressure was 110; diastolic, 60; white blood

cells, 24,000; hemoglobin, 79 per cent. The patient was drowsy and looked ill. The tonsils were hyperemic; the right one was enlarged. Enlarged shotty glands were present in the cervical region. The abdomen was soft; no muscle spasm was present; the patient complained of pain on pressure over the right kidney and over the ureter at the pelvic brim. There was no tenderness over the appendix region. Examination of the urine showed albumin plus, numerous leukocytes and bacteria. On culture, the urine showed a heavy growth of colon bacillus. The diagnosis was acute pyelitis of the right kidney.

The patient took fluids well, and she soon looked and felt much improved but the temperature did not reach normal for nine days. On the ninth day, the right kidney was catheterized and a pure culture of *B. coli* was obtained. A small wax bulb on the catheter detected infiltration in the intramural ureter. The same day, at 8 p.m., the temperature reached 103.2 F. It gradually subsided

Fig. 8 (case 11).—Stricture area near bladder and slight dilatation of the tract above. Normal urine.

to normal on the third day. After ten days of normal temperature, another dilation of the right ureter with a 14 French bulb was followed by another typical attack of pyelitis, the temperature at the end of twenty-four hours being 101.6 F., at forty-eight hours, 102.6 F., and at seventy-two hours, 103.8 F. It returned to normal on the eighth day, and did not rise again after subsequent treatments. At the third dilation of the right side, the urine was found normal and was negative on culture. The right side had four dilatations and the left, two. Urine from the left side was normal (figs. 7 and 8). The patient was dismissed in excellent condition, Nov. 29, 1925, and a report one year later said that she had remained in good health.

CASE 12.—N. W., aged 14, was admitted to the Church Home and Infirmary, Feb. 27, 1925, complaining of pain in the lower right quadrant. The first attack occurred two years previously, when she was taken to the hospital on a diagnosis of appendicitis. Ice caps were used, and she remained in the hospital one week.

She had never had a similar severe attack. About one month previously, the side was so painful that the patient remained home from school for one day. For about a year before the first attack, pus had been present in the urine and pyuria had accompanied the second onset. Methenamine and many other drugs were administered for the pus; the patient thought that the urine has been free from pus for about one year.

On physical examination, the left kidney could not be palpated, and there was no tenderness in this region. The lower pole of the right kidney was barely palpable on deep inspiration and was tender. Both ureters were tender on palpation over the region of the pelvic brim; no tenderness was felt in the region of the appendix.

Urine catheterized from the bladder was normal on microscopic examination, but at the first investigation of the ureters a staphylococcus was cultured from each kidney. An 11 French bulb gave a firm hang in both ureters at a point about 3 or 4 cm. above the bladder. Ten days after the first dilation, a second dilation was done with a 13 French bulb, and at this time urine from both kidneys was normal on culture. The right side was dilated a third time with a 14 French bulb, and at this treatment the urine from the bladder and from the right kidney was normal on culture. A letter from the patient's father, a physician, in November, 1926, reported normal urine and absence of symptoms since the treatments.

CONCLUSIONS

Chronic pyelitis in children is probably subject to the same factors that govern chronic pyelitis in adults. Inadequate drainage is the chief factor in chronic pyelitis, and ureteral stricture is by far the most common cause of poor drainage. The age at which pyelitis occurs is no criterion as to the duration of the stricture, and does not help to determine whether the stricture is congenital or acquired.

Symptoms referable to the gastro-intestinal tract are among the most frequent concomitants of urinary stasis, whether the urine is infected or sterile. If any symptoms or signs of involvement of the urinary tract, such as urinary frequency, backache, pain in the side and tenderness over the kidney or along the course of the ureter, are present, the physician should insist on investigation for ureteral stricture after reasonable treatment for the gastro-intestinal symptoms has proved a failure.

The urinalysis is normal, or approximately so, in 80 per cent of patients suffering from urinary stasis. Hence, it is not wise to defer the urologic examination until infection and pyuria supervene.

THE TREATMENT OF PERSISTENT RICKETS*

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The recent investigations of the various manifestations of rickets have tended to emphasize the aspects of this disorder that are seen in young infants, so that one is apt to lose sight of the fact that evidences of rickets are often found in older children. Although infantile rickets in the active stage is supposed to have disappeared by the end of the second year even when the child is not treated, there are many exceptions to this rule, particularly among negro and Italian children. In the literature the condition is referred to as instances of "relapsing" rickets. This term is a misnomer, since it implies a previous cure of the condition, whereas in these children the disease has progressed and is evident in a most severe form. For this reason it seems more appropriate to call them cases of "persistent" rickets, since this emphasizes the fact that the disease has persisted beyond the infantile period and has shown little tendency to disappear.

This paper presents the observations on eight children, all over 2 years of age, who had definite signs of active rickets and who were carefully observed throughout the course of their treatment. Four of them were over 3 years of age, but the others were below this age. They were included because they were all over 2 and had the disease in a most severe form without evidence of healing.

CASE REPORTS

CASE 1.—R. D., a French-Canadian boy, aged 6½ years, weighing 32½ pounds (14.6 Kg.), was admitted to the hospital on Feb. 27, 1926, with the complaint of bow-legs. The five other children in the family were well. The child was born at full term and weighed 7½ pounds (3.3 Kg.). He first sat up at the age of 5 months, cut his first tooth at 7 months and walked at 2 years. The only disease he had had was pertussis. He was breast fed for one month and then was given a mixture of cow's milk. When 1 year of age, he was given cod liver oil for a short period. The bow-legs were first noticed at 18 months of age, when the mother was told that the child had rickets.

A general examination revealed a small, much undersized child with an extreme degree of bowing of the legs (figs. 1 and 2), severe rickets, frontal bosses, marked rosary, greatly enlarged epiphyses and pronounced pot-belly. The blood contained 2.5 mg. of inorganic phosphorus per hundred cubic centimeters and 8.5 mg. of calcium. Roentgenograms showed marked rickets (fig. 3 A).

CASE 2.—A. F., a French-Canadian boy, illegitimate, aged 4, weighing 29 pounds (13.2 Kg.), was admitted to the hospital on Feb. 13, 1926, with the complaint of a large abdomen. The only history available was that the child was taken to a foundling home at 6 months of age. At that time he was sickly.

* Received for publication, May 31, 1927.
* From the Children's Memorial Hospital.

Fig. 1 (case 1).—Child, aged 6½ years, with severe rickets and extreme bow-legs.

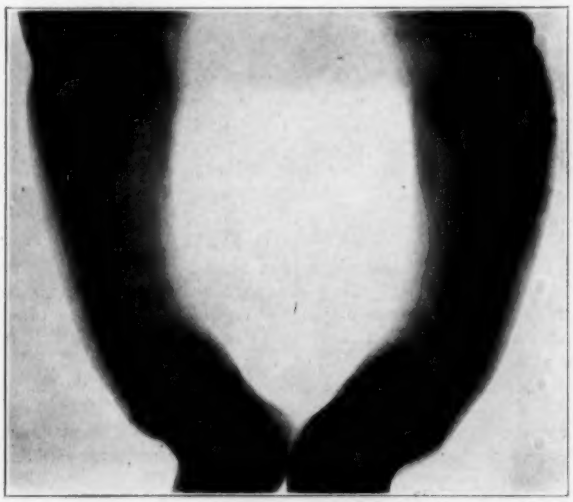

Fig. 2 (case 1).—Roentgenogram of the bow-legs showing the extensive involvement of the bones.

The abdomen began to enlarge about a year before presentation, and had steadily increased in size. The child was able to walk only by holding to a support.

A general examination revealed a poorly nourished, undersized child with severe rickets, frontal bosses, moderate beading, markedly enlarged epiphyses, pigeon chest, marked Harrison sulcus, pronounced pot-belly and slight anterior bowing of the legs. The blood contained 2.6 mg. of phosphorus per hundred cubic centimeters and 6.2 mg. of calcium. Roentgenograms revealed severe rickets.

CASE 3.—A. D., a French-Canadian boy, aged 2, weighing 15 pounds and 2 ounces (6.9 Kg.), was admitted to the hospital on April 2, 1926, with the complaint of deformities of the arms and inability to walk. There were five other children in the family. The child had never walked or sat up, and cried on being moved. He was born at full term with a normal delivery. He had never been breast fed and had not been given orange juice or cod liver oil. His diet consisted of milk, bread and soup. He had had measles at the age of 6 months.

General examination revealed a small, pale, emaciated child with marked deformities of both upper arms and acute angulation of the humerus of each

Fig. 3.—Roentgenograms showing the improvement of marked rickets under treatment with cod liver oil and sunlight. *A* indicates the condition on admission; *B*, three months later and *C* four months later, after an increase in dosage.

arm (fig. 4). Other conditions revealed by the examination were: square head, open fontanelle, no craniotabes, marked beading, moderately enlarged epiphyses, no bowing and slight pot-belly. Roentgenograms showed severe rickets. There were fractures of both humeri, radii and ulnas. (There was so little lime in the bones that they barely offered an obstacle to the roentgen ray.)

CASE 4.—J. P., a French-Canadian boy, aged 2, weighing 20 pounds (9 Kg.), was not able to walk. There were seven other children in the family. The child was born at full term and weighed 9 pounds (4.1 Kg.). He sat up at the age of 7 months and cut his first tooth at 11 months. He was breast fed for two months, then was given milk, porridge, biscuits and bread. He was given cod liver oil and orange juice only occasionally. He was kept indoors most of the time.

General examination revealed a small, pale, poorly nourished child with marked beading, moderately enlarged wrists, slightly anterior bowing of the legs, bowing of the forearms and moderate pot-belly. Roentgenograms showed marked rickets and fractures of both radii and ulnas.

CASE 5.—H. M., a negro boy, aged 3 years, weighing 17½ pounds (7.8 Kg.), was admitted to the hospital on Oct. 18, 1924, because he was not able to walk.

He was born at full term and weighed 9 pounds (4.1 Kg.). As the child was abandoned by the mother, a history of the feeding was not available.

General examination revealed a poorly nourished negro child with a square head, frontal bossing, marked rosary, large epiphyses, prominent abdomen, moderate Harrison's groove and slight bowing. Roentgenograms showed severe rickets and a fractured radius (fig. 5 A).

CASE 6.—M. M., a French-Canadian boy, aged 2 years and 4 months, weighing 20 pounds (9 Kg.), was admitted to the hospital on Dec. 22, 1925, with a complaint of bow-legs. There were three other children in the family. The baby was born at full term and was breast fed for two months, then was given milk, bread and cereal. He had been given cod liver oil and orange juice only occasionally. He seldom went outdoors.

Fig. 4 (case 3).—Roentgenogram of fractures of the humerus, the ulna and of the radius in a child with severe rickets.

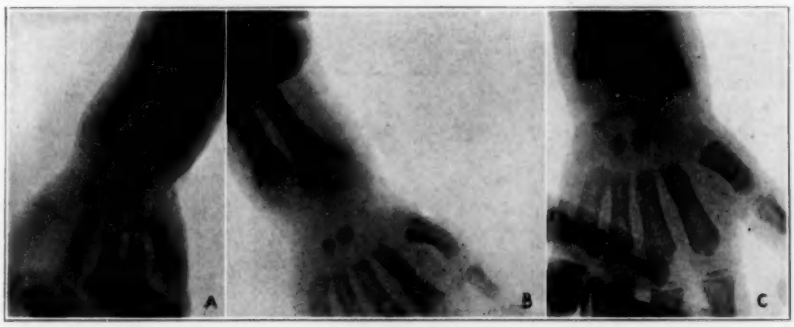

Fig. 5.—Roentgenograms of child with rickets showing the improvement after treatment with cod liver oil and sunlight. *A* indicates the combination on admission; *B*, four months later and *C* two months later after an increase in the dosage.

General examination revealed a pale, poorly nourished child with marked beading, large epiphyses and marked bowing, both laterally and anteriorly. Roentgenograms showed marked rickets.

CASE 7.—L. B., a French-Canadian girl, aged 3½ years, weighing 21 pounds (9.5 Kg.), was admitted to the hospital on Aug. 19, 1925, with the complaint of bowing and a fractured clavicle. There were six other children in the family. The baby, a twin, was born at full term and weighed 5 pounds (2.3 Kg.). She was never breast fed and was never given orange juice. Cod liver oil, 20 minims (1.2 cc.), was given three times a day, two years before presentation. The clavicle had been fractured two years before it was noted that the child had

severe rickets. She now returned with a fracture of the same bone. Previously she had been treated in the outpatient department. General examination revealed a pale, poorly nourished child with marked beading, moderately enlarged epiphyses, marked anterior bowing, slight pot-belly and a slight Harrison's groove. Roentgenograms showed marked rickets and a fractured clavicle.

(This case shows the effect of inadequate treatment. The child was given only 20 minims of cod liver oil three times daily to cure her of active rickets.)

CASE 8.—M. P., a French-Canadian boy, aged 2 years, weighing 20½ pounds (9.1 Kg.), was admitted Aug. 18, 1926, with the complaint of crooked bones.

Fig. 6 (case 8).—Roentgenograms of a severe fracture of the clavicles.

Fig. 7 (case 8).—Roentgenograms of child with severe rickets.

There were two other children in the family. The child was born at full term and weighed 7 pounds (3.2 Kg.). He was breast fed for two months, then was given condensed milk. He was given orange juice but not cod liver oil. At 1 year of age, he was fed milk, cereal and vegetables. He sat up at that age but did not stand. He had eight teeth when 9 months old.

General examination revealed a pale, undernourished child with marked angulation of both clavicles, square head, marked beading, large epiphyses, slight pot-belly, a slight Harrison's groove and slight anterior bowing. Roentgenograms showed marked rickets and a bilateral fracture of the clavicle (figs. 6 and 7).

ETIOLOGY

It is commonly understood that rickets attacks children of Italian and negro parentage quickest and most severely, but no adequate explanation has been submitted. In this connection it should be noted that all but one of the children in this series are French-Canadian (table 1). This is indicative of the marked prevalence of the disease in infants of this nationality, comparable to that among negro and Italian children. There are several factors which may explain this. Many French-Canadians of the poorer class consult the medical profession only as a last resort because they are extremely ignorant of child hygiene. Furthermore, they wean the baby at an early age. Cow's milk and bread form the major part of the artificially fed infant's dietary. Another characteristic of the race is the tendency to have large families; consequently the mother has little time to devote to the children. For this reason, the infants are not taken outdoors often, so that once having contracted rickets, they are denied the natural healing effects of the sun's rays. An instance of this is furnished in the case of family M. There are four children, the oldest, J, being 4 years old; the next, M, 2½ years; another, R, 15 months and the baby, A, 4 months. All were breast fed for two months except the youngest, who was nursed for four months. J did not present signs of rickets; the second child, M, had severe rickets; the third, R, showed moderate rickets and the baby did not have rickets. The first child was fairly well cared for and was taken outdoors often. The next two children, according to the mother, seldom went out, and the last child is being taken care of the best of all since the mother has begun to attend the clinic.

The fact that the diet of these children was the same in every instance is of great interest. This would seem to indicate that the main etiologic factor in the production of rickets was the confinement indoors and that the deficiency in diet was of secondary importance. Although it was not possible in all of the cases studied to elicit full information on this point, it is significant that two of the children in the series came from orphanages where they had been kept since early infancy. Here, although the diet was deficient in many respects, the most important fault was their confinement indoors.

SYMPTOMATOLOGY

The signs of rickets in the older children were the same as in infants, namely, enlargement of the costochondral junctions and of the epiphyses and bowing of the legs, as well as other deformities. The roentgenogram of the bones and the chemical examination of the blood showed similar changes to those found at the earlier age. Craniotabes is not present after infancy. These clinical signs of infantile rickets were greatly exaggerated; the beading was most marked and the enlargement of the

epiphyses extreme. The rachitic deformities, such as retraction of the chest and bowing of the legs, were unusually severe (figs. 1 and 2). Another remarkable feature was the frequent occurrence of fractures of the long bones, no less than five of the eight children under observation being thus afflicted. Moreover, in most instances several bones were involved, and there were even multiple fractures of the same bone (fig. 4). It is noteworthy that the presence of these fractures was unsuspected, except when marked deformity existed, the diagnosis having been made only by roentgenogram.

The significance of these marked changes is that in these older children rickets was severe and advanced. It not only had persisted from infancy, but had progressed because the factors that originated the disorder were not remedied. For this reason the term "relapsing" rickets

*Duration of Treatment in Cases of Persistent Rickets**

Case No.	Admitted, Date	Age, Years	Nationality	Breast Fed, Months	Cod Liver Oil, 3 Drams, Months	Cod Liver Oil, 6 Drams, Months	Total Months	Comment
1	Feb. 27/26	6½	French-Canadian	1	3	5	8	
2	Feb. 13/26	4	French-Canadian	0	3	4	7	
3	Apr. 2/26	2	French-Canadian	0	6	—	6	Multiple fractures
4	Sep. 22, 25	2¼	French-Canadian	2	10	—	10	Multiple fractures
5	Oct. 18/24	3	Negro	—	4	4	8	Fractures
6	†Dec. 22/25	2½	French-Canadian	2	6	1	7	
7	†Aug. 19/24	3½	French-Canadian	0	13	—	13	Fractures
8	Aug. 18/26	2	French-Canadian	2	6	—	6	Fractures

* All had abundant sunshine in addition, having been kept outdoors continually throughout the course of the treatment.

† These were treated in the outpatient department.

appears inadequate to describe this type of case, although it seems suitable for those in which recurrences have been shown to have taken place. The term "persistent" rickets emphasizes the fact that the disorder is of long duration, and has lasted beyond the usual age, thus accounting for the unwonted severity of its manifestations in the older children.

TREATMENT

It can readily be understood that for such severe changes ordinary treatment would be unavailing, and that since the disease had persisted for such a long period, a long interval would be necessary to effect a cure. This is borne out by observation (table 1). The children were all given cod liver oil in doses of 1 dram three times daily. They were kept outdoors almost continually, so that they became deeply tanned. In spite of this treatment for as long periods as three and four months, the disease showed only slight signs of disappearing. In four instances

the dose of the oil was increased to 2 drams (7.5 cc.), three times daily, and the treatment in the open air was continued. This brought a definite response; the youngest children of the latter group showed a cure within one month and the oldest within four months after the increase in dosage. Nevertheless, the total interval required to complete the healing process was from six to thirteen months. On consulting the reproductions of the roentgenograms in case 1, it will be noted that figure 3*A*, taken on admission, shows severe rickets; figure 3*B*, three months later, shows a fair degree of healing, but less than is ordinarily expected after three months of treatment with cod liver oil and sunlight. At this point [1] the dose of the oil was doubled. Figure 3*C*, taken four months later, shows complete healing. However, there was still marked rosary and great enlargement of the epiphyses, which disappeared only after four months more of this intensive treatment. Similar changes may be noted in case 5. Figure 5*A* shows severe rickets, figure 5*B*, little healing after four months treatment with cod liver oil and sunlight, figure 5*C*, healed rickets after two months of the increased dosage of oil. Here, too, it took several months more until the clinical signs had disappeared. Two of the younger children, despite a more severe form of rickets, as evidenced by the presence of multiple fractures, responded to a smaller amount of total treatment than the older ones (table 1, cases 3 and 8), but a much greater amount than is ordinarily required for infantile rickets. In the two other children of the same age (cases 4 and 7) who were not given the increased dosage, the intervals necessary for a cure were ten and thirteen months, respectively. These were being treated while attending the outpatient department; they received the cod liver oil irregularly, and were exposed less to the sun's rays. Thus it may be seen that in the treatment of rickets by means of cod liver oil as well as by sunlight, the result obtained is dependent on the total amount administered, a cure being obtained in a shorter time by a larger quantity of the oil. Furthermore, it would seem that in many instances the younger children need less total therapy than the older ones.

COMMENT

In discussing the therapy of rickets, it is important to make clear on what evidence the diagnosis of this disturbance is based, for much misconception exists as to what does and what does not constitute rickets. For example, although it has been shown that craniotabes can be regarded as rachitic only when it occurs after 4 months of age,[2] its presence is often cited as an important sign of the existence of rickets in

1. This roentgenogram was taken two weeks after the dose of oil had been doubled.

2. Barenberg, L., and Bloomberg, M. W.: The Significance of Craniotabes and Bowing of the Legs, Am. J. Dis. Child. **28**:716 (Dec.) 1924.

infants under this age. Similarly, the presence of cranial bosses or deformed chest or bow-legs has been accepted as the criterion of rickets whereas they are merely secondary signs of the disease. There are several changes produced by rickets and not duplicated by any other disease, namely craniotabes (after four months), beading of the ribs, enlargement of the epiphyses, lowering in amount of the inorganic phosphorus content of the blood and changes in the bones disclosed by the roentgen ray. For the sake of uniformity, it would seem advisable to adopt these criteria of the disease in order that there may be a common basis for discussion. It is also important not to diagnose the absence of rickets from the absence of any of these signs alone, as they appear at different stages of the disease, and it is only in the well marked case that all are present.

In the cases herein cited these signs were present (excepting craniotabes), and cure was said to be complete when all had disappeared. It was noted in most instances that the beading of the ribs and enlargement of the epiphyses persisted for many months after the roentgen ray showed apparently complete healing.

It is apparent that a deficiency either in diet or in sunlight may produce rickets, and when both exist, as was evident in most of the cases presented, the resultant disease assumes a most severe form. Patients with this type of rickets do not respond to ordinary therapy, such as small doses of cod liver oil, even when combined with heliotherapy (sunlight). It was only when huge doses were administered that healing was obtained. The often reported failure of cod liver oil is undoubtedly due to the fact that too small doses have been given, as well as to the fact that attempts have been made to cure severe deformities such as bow-legs and a deformed chest by means of this remedy. In young infants bowing disappears either with or without treatment,[2] whereas in the older children this deformity is not amenable to medical treatment, operative measures being necessary. Similarly, a well marked deformity of the wall of the chest, even if caused by rickets, will not respond to medical treatment, which cures active disease but not deformities. Other failures of the oil are due to the fact that the patients are being treated outside the hospital and so receive the remedy with great irregularity.

It is extremely difficult to fix the curative dose of cod liver oil. From the observations presented here, it would seem that one must take into consideration the duration and severity of the disease, the diet, the amount of sunlight the child receives and possibly the age of the patient as well. The tendency has been to give rather too small amounts of the oil. Moreover, since in many of these children the disease persisted throughout the summer months, it would seem advisable to continue giving cod liver oil during these months to premature babies and twins,

as they are specially susceptible to rickets. This procedure does not produce nearly as much gastro-intestinal disturbance as is commonly believed.

SUMMARY

Although rickets usually disappears by the end of the second year, it often persists beyond this age. Eight such instances are presented in this paper. In all, the disease was of an extremely severe type, as evidenced by exaggeration of the usual clinical signs of infantile rickets. Ordinary antirachitic therapy was inadequate; it was only when huge doses of cod liver oil were given along with abundant exposure to the sun's rays that proper healing was obtained.

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DIAPHRAGMATIC PARALYSIS RESULTING FROM INJURY OF THE BRACHIAL PLEXUS*

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I am well aware that injuries of the brachial plexus occurring at birth have been fully described in the medical literature. There are, however, certain complications of the condition that apparently have escaped notice, and that are of more frequent occurrence than the reports in the literature indicate. It is with this in mind that I have reported and discussed the following case of palsy of the phrenic nerve due to injury of the brachial plexus at birth.

REPORT OF A CASE

History.—S. G., a girl, aged 3½ months, was brought to me on Sept. 9, 1924, because of failure to gain in weight. The mother was a primipara whose labor had been unusually difficult and prolonged. Because of a full breech presentation, the services of a consulting obstetrician were required for the extraction of the head. Resuscitation of the infant was readily accomplished, and the cyanosis, considerable at birth, gradually disappeared. The respiratory rate, however, continued to be accelerated and somewhat irregular. A fracture of the upper third of the left humerus, sustained at birth, healed with perfect function. Within a few days, an Erb-Duchenne paralysis of the upper right extremity manifested itself, but improved considerably under mechanotherapy.

The infant weighed 3,200 Gm. at birth. The breast feedings, given at three hour intervals, were poorly taken. Because of difficulty in breathing, the child was compelled to interrupt its feedings for periods of rest.

Physical Examination.—The infant was fairly well nourished, weighing 4.160 Gm., and had developed normally except in the following particulars. The chest was somewhat flattened in the anterior-posterior diameter; the middle of the sternum retracted with each inspiration; the excursion of the right side of the chest was considerably impaired and lagged, this side moving as a whole and lacking the rhythmical, wavy expansion of the ribs; the left side of the chest appeared long and thin, the ribs descending in an oblique direction with the interspaces considerably narrowed, while the right side appeared full and short, the ribs occupying a horizontal position and the interspaces being wider than normal. Respiration was irregular and rapid, at times 90 a minute. Posteriorly, at each inspiration retraction of the interspaces of the left side was noticeable. Percussion showed hyperresonance throughout the left side of the chest, the lower margin of the lung reaching the eleventh rib posteriorly. The right side of the chest presented impairment of resonance from the midscapular region to the base of the lung, simulating a consolidation. Anteriorly, the dulness extended from the fourth rib to the costal margin. Auscultation revealed normal breath sounds over the left side of the chest; over the dull area in the right side of the chest the breath sounds were diminished and at the base were entirely absent. Vocal and tactile fremitus were diminished, but no râles were heard. The left border of the heart was at the nipple line in the fourth interspace; the right border was difficult to determine because of the deformity of the sternum. The heart sounds were rapid but clear, and no adventitious sounds could be heard. The abdomen was retracted below the level of the chest and soft to palpation.

* Received for publication, May 25, 1927.

The left side of the epigastrium was considerably fuller than the right. Abdominal respiratory movements were present at the left side, but strikingly absent at the right. Lack of respiratory bulging was conspicuously evident to the palpating hand when placed gently over the right side of the epigastrium. The spleen extended just below the costal margin, but the liver could not be palpated in spite of the relaxed condition of the abdomen.

Results of a fluoroscopic examination made on September 16, were reported as follows: The right side of the diaphragm was at the level of the fifth interspace, posteriorly, the left side of the diaphragm in position at the tenth rib, posteriorly. The diaphragm showed typical paradoxic seesaw movements, the right side ascending during inspiration and descending during expiration, whereas the left side showed normal respiratory excursions. The entire right lung was

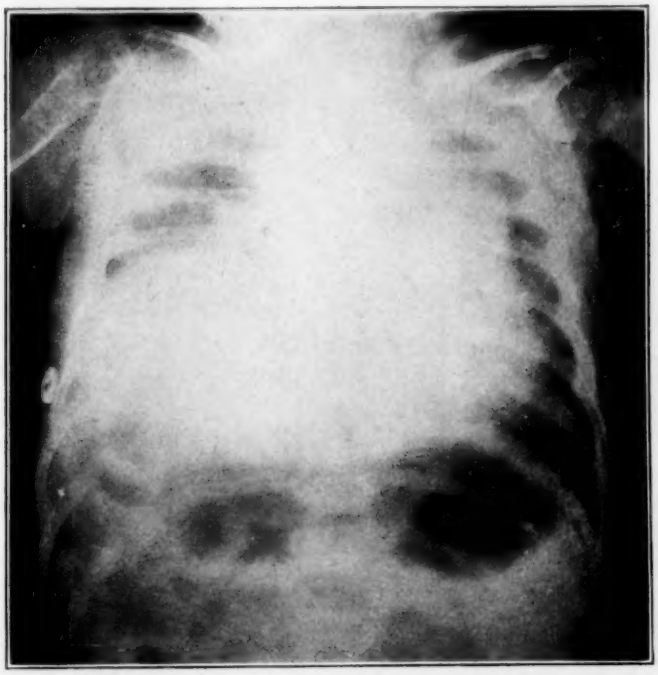

Fig. 1.—Roentgenogram of the patient at 3½ months of age, showing the high position of the diaphragm.

cloudy, due to atelectasis and deficient ventilation. The heart was in the left side of the chest. The physical conditions suggested paralysis of the right side of the diaphragm.

A roentgenogram taken on the same day revealed the entire heart in the left side of the chest. The base was more displaced than the apex; the left side of the diaphragm was normal; the trachea was in the midline; the right side of the diaphragm was high and normal in contour. The liver occupied a high position. There was a thickening of the interlobar pleura in the right side of the chest.

Course of Illness.—The patient has been observed at regular intervals for the past two and one half years, during which time the respiratory rate has slowed down considerably. The infant has occasional attacks of shortness of breath, especially after the exertion of feeding or crying, but cyanosis does not occur. Because of the baby's failure to gain in weight, a complementary feeding of milk

and cereal water was ordered. This was taken poorly. Repeated examinations showed the same physical conditions, which was convincing evidence that the phrenic paralysis still persisted.

At the age of 3 months, the child had an attack of cough and fever which lasted for five days. The temperature varied between 101 and 103 F. Respirations were labored and accompanied by grunting. Examination of the chest revealed high pitched breathing at the right interscapular region and numerous fine râles throughout the right side. Slight cyanosis of the lips and finger-nails was present. At the age of 5 months, a similar illness occurred accompanied by identical symptoms; this attack, however, lasted only three days. These two attacks of bronchopneumonia were interpreted on the basis of an existing lowered resistance of the right lung due to the lack of aeration.

Fig. 2.—Roentgenogram of the patient at 26 months of age, showing that the high position of the right side of the diaphragm still persists.

At the age of six months, the baby appeared undernourished, weighing only 13½ pounds (6 Kg.). A fluoroscopic examination showed persistence of the condition revealed by the first examination. At 13 months, a roentgenogram and fluoroscopic examination did not disclose improvement in the paralysis of the right side of the diaphragm. The patient was well in every respect except for the undernourished condition and the deformity of the chest due to the retraction of the lower half of the sternum.

In January, 1926, the patient had another respiratory infection which, similar to the previous attacks, was confined to the right side of the chest, and which lasted one week. On Oct. 11, 1926, at the age of 2 years and 3 months, examination showed a well-developed, undernourished, pale-looking child, with marked deformity of the lower sternum, but otherwise happy and active. Exami-

nation of the chest revealed impairment of excursion on the right side, dulness at the base and a somewhat accelerated respiratory rate. Fluoroscopic examination on the same date showed the right side of the diaphragm still in its high position and the paradoxic movement still present.

COMMENT

The brachial plexus, due to its exposed anatomic situation, is a frequent site of injury to the nerve, with resulting paralysis. In 1877, Erb first called attention to this type of paralysis in the adult. Later Duchenne described an analogous condition in the new-born, and to this has been given the name "Erb-Duchenne paralysis." Seligmuhler first called attention to the possibility of a coincident sympathetic lesion in injuries of the brachial plexus. It was Naunyn,[1] however, in 1902, who first recorded a case of unilateral palsy of the phrenic nerve due to injury of the brachial plexus. His patient, a man, aged 20, fell on a pile of stones, where he lay unconscious for two hours with his left arm extended under his head; on awakening, an Erb's palsy and paralysis of the sympathetic nerve were present. Fluoroscopy of the thorax showed paralysis of the left half of the diaphragm and a normal excursion of the right half. Naunyn interpreted this paralysis as resulting from an injury to the phrenic nerve, which receives fibers from the fifth to the seventh cervical segments.

The infrequency of paralysis of the phrenic nerve is due to its well protected anatomic position in the neck; and in the few cases reported in the literature, none of which occurred at birth, the injury was the result of an unusual or even bizarre accident. Thus, in the case of Moritz,[2] the injury was caused by a bite of a horse, the boy's neck being caught between the upper and lower jaws of the animal. In Frischauer's [3] case the accident occurred in a woman, whose neck was pinched in an elevator.

It is reasonable to assume that the fibers that form the phrenic nerve may be injured in certain difficult deliveries in which undue traction is exerted on the brachial plexus; yet not a single case of obstetric injury to the phrenic nerve was recorded in the medical literature up to 1921, when Kofferath [4] for the first time recognized the condition and described its symptoms. During my observation of

1. Naunyn, B.: Ein Fall von Erbscher Plexuslahmung mit gleichseitiger Sympathicuslahmung, Deutsche med. Wchnschr. **7**:13, 1902.

2. Moritz, P.: Mitbeteiligung des Phrenicus bei Duchenne Erbscher Lahmung, Deutsche med. Wchnschr. **32**:909, 1906.

3. Frischauer, H.: Ein Fall von Erbscher Plexuslahmung mit seltenem Symptomkomplex nebst Bemerkungen zur Symptomatologie des Phrenicuslahmung, Wein. klin. Wchnschr. **44**:1167, 1905.

4. Kofferath, Walter: Ueber einem Fall von rechtseitiger Erbscher Lahmung und Phrenicuslahmung nach Zangen-extraktion, Monatschr. f. Geburtsh. u. Gynäk. **55**:33 (July) 1921.

the case reported, a detailed account of a similar case was given by Friedman and Chamberlin.[5]

Injury to the phrenic nerve in the new-born occurs only in conjunction with injury to the brachial plexus, the result of which is paralysis of the diaphragm on the corresponding side and the accompanying disturbance in the mechanism of respiration. Injury to the phrenic nerve without concurrent involvement of the plexus has never been cited in the literature, nor can one conceive of such a phenomenon. The inference, then, would be that difficult labors, extractions by forceps and especially breech presentations are the factors producing such an injury. The ultimate result, complete recovery or permanent paralysis, depends on the extent of the injury, on whether complete or partial laceration of the nerve fibers occurred. Thus in the case of Kofferath, and in that of Friedman and Chamberlin recovery took place before the end of the first year, while in my case the diaphragmatic paralysis appeared to be permanent, since the condition remained unaltered for over two years.

From the cases cited, it is evident that a paralyzed arm, which is accessible to treatment, returns to normal more quickly than the inaccessible paralyzed diaphragm. The fact that in all cases reported this accident occurred in the female child and only on the right side has to be regarded as a mere coincidence, as there is no anatomic basis for its explanation.

SYMPTOMS AND DIAGNOSIS

All the symptoms of the condition are referable to the disturbance of respiration caused by unilateral paralysis of the diaphragm. Naunyn,[1] Moritz,[2] Frieschauer,[3] Galeazzi,[6] Huismans,[7] Kalb,[8] Rumpf[9] and Winterstein[10] have given detailed descriptions of the symptomatology of diaphragmatic paralysis as the result of injury to the brachial plexus in the adult. In the new-born, however, the picture is more striking, and the symptoms vary materially from those in the adult since in the former the lung on the affected side has never been expanded by air, and a state of atelectasis exists. Rapid and irregular respiration, cyanosis, lessened excursion of one side of the chest, lack of respiratory

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5. Friedman, Emanuel, and Chamberlain, R. S.: Phrenic Nerve Injury in the New-Born, J. A. M. A. **86**:934 (March 27), 1926.

6. Galeazzi, R.: Contributo clinico e sperimentale alle studio delle lesioni del plesso brachislie d'origine traumatica, Arch. di ortop. **20**:1, 1903.

7. Huismans: Halbseitige Zwerchfellahmung nach Stich in den Plexus Brachialis, München. med. Wchnschr. **47**:1615, 1915.

8. Kalb, O.: Ein Fall von hoher Plexus zerreissung, Deutsche Ztschr. f. Chir. **88**:572, 1907.

9. Rumpf: Kombinierte Armlahmung (Erbscher Typus) mit Lahmung des linken N. phrenicus, Deutsche med. Wchnschr. **41**:661, 1915

10. Winterstein, O.: Zur Phrenicuslahmung bei Lahmung des Plexus brachialis, Mitt. a. d. Grenzgeb. d. Med. u. Chir. **34**:188, 1921.

bulging of the epigastrium on the affected side and dulness at the base of the lung in conjunction with an Erb palsy are the cardinal points which should lead to the proper diagnosis. Fluoroscopic examination of the chest showing the paradoxic movement of the diaphragm will not only verify the diagnosis, but also will help to differentiate all the possible conditions in the new-born in whom respiratory and circulatory disturbances are present, such as cerebral hemorrhage, congenital heart disease, persistent thymus, pneumonia and diaphragmatic hernia.

CONCLUSIONS

1. The phrenic nerve is subject to injury during birth in conjunction with laceration of the brachial plexus.

2. The diaphragmatic paralysis resulting from such an injury may be either temporary or permanent.

3. Dyspnea, an irregular respiration, will continue as long as the paralysis exists.

4. Lack of aeration of the affected side will predispose the patient to respiratory infections.

5. A deformity of the chest which manifests itself in a retracted sternum is present in this condition.

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INTUSSUSCEPTION TERMINATING IN "SPONTANEOUS ELIMINATION"

REPORT OF A CASE WITH COMPLETE RECOVERY *

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On June 7, 1926, W. V., a boy, aged 4 years, whose history did not reveal any acute illnesses, was brought to a medical clinic conducted by me, with the complaint that he had been subject to mild convulsive seizures for the past two years. The seizures did not appear from the meager description to be epileptiform. They were characterized by a few jerky movements of the head and arms following which he would "sit and stare for a few minutes." Physical examination did not reveal any obvious cause for the attacks, and no convulsive seizures were witnessed. A diagnosis was not made, but it was suggested that a thorough search of the stools be made for parasitic ova. A search was not made.

On July 12, at a subsequent clinic, the specimen, a portion of which is shown in figure 1, was brought in for identification, with the history of the following events having transpired since June 7. The child continued to have attacks at two or three day intervals until July 1; at this time he had an acute condition with high fever, marked prostration and frequent passages of stools consisting only of blood and mucus. The diagnosis of dysentery, which was prevalent at that time, was made, and treatment instituted accordingly. He apparently made a good recovery, and on July 11 passed, with a normal appearing stool, what the mother thought was a large worm, together with ten or twelve segments of a taenia. The segments of the tapeworm were later identified as being a portion of a *Taenia saginata*. The "large worm" was 14 inches (35.48 cm.) in length and about ¼ inch (0.6 cm.) in diameter. Gross examination revealed tabs of mesentery, and portions of small vessels could be identified on the outer surface. Microscopic examinations by Dr. Peterson of the department of pathology, Washington University School of Medicine, verified the impression that the specimen was a portion of the human intestine. The exact source of the specimen cannot be stated definitely, although it is thought to have been a piece of the ileum.

COMMENT

Intussusception of one type or another occurs frequently, as the numerous reports of isolated cases each year indicate. The condition is usually recognized immediately and treatment instituted, so that little chance is offered for the condition to run its course. This may lead to one of two terminations. The most frequent occurrence is the production of a complete intestinal obstruction with a sloughing of the part and a resulting peritonitis, unless the patient dies meanwhile from toxemia and exhaustion. The other termination may be an auto-

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* From the Department of Internal Medicine, Washington University School of Medicine, and Barnes Hospital.

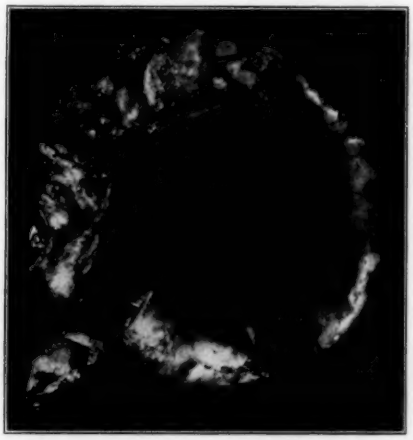

Fig. 1.—Portion of the specimen, showing a small secondary intussusception at one end.

Fig. 2.—Cross-section of the specimen, demonstrating the structure to be that of the small intestine.

anastomosis of the two parts of the intestine, with a "spontaneous elimination" of the intervening section.

Before the advent of surgery, the termination of intussusception with spontaneous elimination and recovery must have been a comparatively frequent occurrence, as Leichtenstern [1] makes the statement that 42 per cent of his series of 593 cases underwent spontaneous elimination. Since the publication of his work in 1877, few cases terminating in such a manner have been observed.

O'Connor and Sutcliffe,[2] in 1894, each reported a single case of intussusception terminating in spontaneous elimination and recovery.

Sherren,[3] in 1906, reported a case of spontaneous elimination occurring in a woman, following an operation for the reduction of a hernia. This same case was later included in a series of cases of intussusception reported by Walton,[4] in 1911; it was the only one in his series of 239 cases of intussusception.

Fitzwilliams,[5] in 1908, reported a series of 1,000 cases of intussusception and does not mention a single case undergoing spontaneous elimination, although he does not make any definite statement regarding the occurrence of such cases.

Perrin and Lindsay,[6] in 1921, reported a series of cases of intussusception occurring over a period from 1903 to 1921. They reported 400 cases, but made the statement that spontaneous elimination did not occur in a single case.

Sir Frederick Treves,[7] in his book "Intestinal Obstruction" in 1901, reviews the subject of spontaneous elimination at some length and explains in detail the probable mechanism of such an occurrence. His explanation is as follows: Adhesions form between the peritoneal surfaces of the entering portion and the ensheathing portions of the intestine. If a separation takes place first at the end of the middle layer nearest to the neck or ensheathing layer the intussusception will straighten out at the apex, and then later as separation takes place in

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1. Leichtenstern, O.: Ziemssen's Cyclopedia of the Practice of Medicine, **7**:613, 1877.

2. O'Connor, E. M. H.: A Remarkable Case of Intussusception, Brit. M. J. **2**:123, 1894. Sutcliffe, A.: Case of Intussusception with Sloughing of Intestine, Brit. M. J. **2**:124, 1894.

3. Sherren, J.: A Clinical Lecture on Acute Intussusception, Clin. J. **27**:185, 1906.

4. Walton, A. J.: Practitioner **87**:186, 1911.

5. Fitzwilliams, D. C.: The Pathology and Etiology of Intussusception from the Study of 1,000 Cases, Lancet **1**:628 and 709, 1908.

6. Perrin, W. S., and Lindsay, E. C.: Intussusception: A Monograph Based on 400 Cases, Brit. J. Surg. **9**:46, 1921.

7. Treves, Sir Frederick: Intestinal Obstruction, London, Cassell & Company, Ltd., 1901.

the middle layer near the entering portion of the intestine the section will be passed with its peritoneal layer outermost. This is the most frequent occurrence. On the other hand, if the separation takes place at the two ends of the middle layer in the reverse order, the section will be passed with its mucus surface outermost. Thus, the intestine will be turned inside out.

It is generally recognized that an intussusception may be initiated by anything which acts as a foreign body in the wall of the intestine and thus gives a relatively fixed point in the wall. Hyperplasia of lymph follicles, papillomas and other tumors, local palsies and intestinal parasites have all been noted frequently as causing such fixed places in the wall of the intestines.

The preceding case report emphasizes the fact that acute intussusception may simulate bacillary dysentery in children, especially if it occurs during an epidemic of dysentery. The case also demonstrates the coincidence of intussusception with the presence of intestinal parasites, and is of further interest in that it terminated with auto-anastomosis and spontaneous elimination, which is rarely seen in this generation.

SUMMARY

A case of intussusception terminating in auto-anastomosis and spontaneous elimination is reported.

The coincidence of intussusception with the presence of intestinal parasites is recorded.

A brief review of the literature indicating the relative infrequency of spontaneous elimination is presented.

Progress in Pediatrics

PERSISTENT VAGINAL DISCHARGE IN INFANTS AND IN LITTLE GIRLS

CAUSE AND TREATMENT *

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The usual treatment for acute vulvovaginitis in infants and in little girls has seemed fairly satisfactory, because, with ordinary measures insuring cleanliness and mild antisepsis, the condition is apt to be self-limited. The treatment for chronic vaginitis or vulvovaginitis, especially with a complicating endocervicitis, offers a much more difficult problem. I will present some material which has been of great assistance in the study and treatment of these obstinate cases in private and in institutional practice.

The common complaint is of a vaginal discharge of long duration which is noticed because the clothing is stained, or because there is irritation about the vulva. Burning urination or the presence of an odor may be the complaint. Occasionally there is a history of atypical acute vulvovaginitis, preceding the chronic condition, but it is uncommon to obtain a history of real value in regard to the possible source of infection. The picture is further obscured by the fact that gonococci can rarely be demonstrated. As a rule the etiology is doubtful, the treatment poorly defined, and the prognosis speculative. Without an attempt at completeness, I will briefly review a few of the significant etiologic factors, and present a working diagnostic and therapeutic plan which embodies certain valuable innovations.

HISTORY

The history of the case should be taken with the greatest thoroughness. It is important not only to trace all possible sources of gonorrheal infection, but also to exclude contributory causes such as infestation with pinworms, eczema, poisoning by poison oak or ivy, adherent foreskin, old smegma deposits, ammoniacal dermatitis, fecal contamination and other manifestations due to filth or neglect. There may be irritation due to hyperacidity of the urine or to glycosuria. These conditions may

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* Read at a Meeting of the Staff of the Emanuel Hospital, Portland, Ore., March 8, 1927.

determine a vulvitis, per se, or set up chafing and scratching of the parts with resultant inflammation. Masturbation is a common sequel to vulvar irritation, and is frequently the most important factor in maintaining the infection. A urethritis or occasionally a proctitis (most often gonorrheal) may act as a focus. The possibility of infection in Skene's or Bartolin's glands must also be considered. I think that the feeling of helplessness which is experienced in treating these patients is largely due to the fact that one so often fails to reach the relatively simple contributory condition. It is important not to confuse a secondary infection with a primary one, and to remember that an infection of long standing may result in a condition resembling an acute attack. These are additional reasons for taking a careful history.

The source of gonorrheal infection in the child is difficult to trace. Parents or others who are responsible will seldom assume blame, even if they are infected. It is unusual to obtain a history of infection even from an adult patient. If a child is infected, it is far less likely that the guilty member of the household will confess, even if the child's infection be ever so innocently contracted. In the experience of most of us, cases are seldom found in which the infection is contracted from criminal practices. I believe that the majority of infections occur through ignorance of the mother or some other woman caring for the child, who transfers an unrecognized infection from herself to the child, perhaps often in an effort to keep the child clean. I have one case in mind, in which the mother, who by the way is a trained nurse, told me that she cleaned the child's genitals three times daily, inserting applicators to cleanse the vagina. The child soon developed an irritating vaginal discharge, and later became an habitual masturbator. The mother became so worried over this development that she persuaded a surgeon to excise the clitoris. The operation was a therapeutic failure. When I first saw the child, she was still untreated for the original vulvovaginitis. She was said to be masturbating as much as ever.

Ordinarily the tub bath will suffice to keep the child's genitals clean, and it is inadvisable for the mother to attempt to be too scrupulous. One of my patients apparently contracted the infection during a course of daily enemas which were rather carelessly given by the mother. In another case, the only suggestive history was the use of a common dressing room after swimming in a school tank. The nearest I have come to the admission of a gonorrheal infection in the home was in one case in which a woman who came in to assist with the work by the day admitted having syphilis. It seems fair to infer that she also had a gonorrheal infection, perhaps unknown to herself.

If it is remembered that the gonococcus is transmitted only by moist, fresh discharge from an infected person, and that a considerable amount is usually necessary, conclusions can be drawn in regard to the likeli-

hood of transmission by towels, toilets, bath tubs and other articles. The organism is killed by drying, exposure to light, mild degrees of heat and mild antiseptics. I agree with Taussig and the majority of others, who believe that in schools and other institutions, infection most frequently occurs from old fashioned, full oval toilet seats. Little children are most apt to become infected and to spread infection because of the necessity of sliding on and off the high seat. For this reason, the horseshoe shaped seat is advisable.

In regard to criminal practices with children, one can only speculate. In the present day, when parents are home but little, and small discrimination is used in the selection of a nursemaid, it is probable that masturbation is not infrequently allowed or even encouraged. If not supervised, children may develop such practices among themselves. In institutional practice, infections are frequently seen following attempted rape. Incidentally, it may be of interest to note that the sadist or other degenerate is not the only one who is involved in these cases. Among a certain European race which forms a large part of our foreign population, there is a superstition which teaches that gonorrhea can be cured by intercourse with a virgin; children are occasionally attacked for this reason.

EXAMINATION

The examination must be careful and thorough. I can not emphasize too strongly the importance of an accurate estimate of the child's general condition. A simple catarrhal vaginitis is common in high-strung, neurasthenic girls. Often, such a discharge is noted only when the child suffers from fatigue or nervous depression. Anemia, malnutrition or debility of any sort are strikingly associated with relapses or exacerbations of the chronic condition.

In the effort to find the gonococci, repeated smears should be taken deeply from the vagina as well as from the vulva and urethra. Cotton applicators are apt to cause friction and frighten the patient. If used, they should be small and tightly wrapped. Lamb's wool as prepared for tampons causes less friction. A fine glass rod, rounded at the end, or a wire loop will serve if the secretion is sufficient. It may help to warm these to the temperature of the body. As this procedure is the first approach to the patient, it is important not to excite fear. If two fingers of the left hand are placed at either side of the fourchet, about 1 cm. posterior to it, and firm, gentle pressure made laterally and posteriorly, the hymen will be widely exposed; if the child is then made to bear down, as in moving bowels, the lips of the hymeneal foramen will pout, and the applicator can be inserted with complete precision.

It is occasionally necessary to incise the hymen, under anesthesia, to allow the introduction of instruments. This operation in itself should assist in clearing up the infection by giving better drainage.

Two sets of smears should be taken at intervals of two days, and the entire field should be gone over. A simple stain and one by Gram's method should be used on each set. If gonococci are not found, after another interval of two days, a warm solution of from 0.5 to 1 per cent silver nitrate should be injected by means of an eye dropper, and smears again taken after twenty-four hours (method of van Giesen).

Organisms may occasionally be demonstrated in the sediment of vaginal washings. The child should be placed over the pan of a

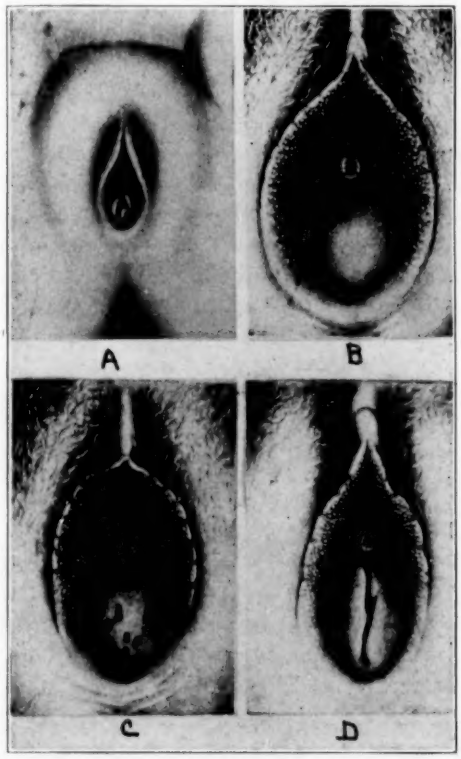

Fig. 1.—The hymen has been exposed by the procedure described. The foramen in *A* is the most typical; *B*, *C* and *D* show the adult habitus, but illustrate the necessity of carefully inspecting the hymen before attempting to insert a probe or applicator. The relative occlusion of the vaginal outlet in every case is obvious, especially if comparison is made with figure 4. *A* shows the infantile type of hymen; *B*, the inperforate hymen; *C*, the cribriform hymen and *D*, the vertical hymen (Williams' Obstetrics).

cystoscopic table (a bed pan will do), and the vagina flushed with from 3 to 5 ounces of warm sterile water through a number 4 to 7 rubber or glass catheter. The catheter should be introduced high and the solution injected under mild pressure. Elevating the funnel a foot or more will

suffice. The washings are caught and allowed to stand in a glass graduate, after being stirred and examined for mucus. After several hours, a sufficient amount is decanted and the remainder centrifugalized. The sediment should be examined grossly for mucus, and then smeared and stained. I believe that this method is not often successful when the simpler methods have failed. Smears from the urethra and rectum should be taken also if there is any indication of infection. The value of the complement-fixation test in making the diagnosis has not been definitely established. Gittings' answers from 690 physicians and hospital staffs bear out the observations of others that a positive reaction is not constant, even in the presence of a positive clinical and microscopic diagnosis, and that there is frequently a mildly positive reaction in clinically cured cases. The test is unreliable except in the most expert hands. Vaccine therapy is on an equally indefinite basis, but should be used in an attempt to reinforce local measures.

It is important to determine the presence or absence of the gonococcus. There is considerable question, however, as to whether every intractable vaginal discharge in a child should not be treated as gonorrheal. In general this seems a wise course, but it should be tempered, for it is possible to make the treatment worse than the disease. After all, a chronic vulvovaginitis in a child is probably attended with less danger of extension or dissemination than is a severe nasopharyngitis. The organisms, especially in the chronic cases, are of mild virulence, and extension to the pelvic viscera, to Skene's or Bartolin's glands or to the cervix is rare. The treatment should be thorough, but the personality of the child must also be taken into account. A mistaken diagnosis of gonorrheal vaginitis is occasionally made in infants on the basis of a glairy discharge containing a few pus cells and large biscuit shaped diplococci. If these organisms are *Micrococcus catarrhalis,* they will be difficult to classify by Gram's decolorization, and may also be intracellular. Such an occurrence is not unusual, especially in the first two weeks of life, and the differentiation can be made by cultures and the use of fermentation tests. As a rule local treatment is not required.

Extension of the infection to the endocervix is unusual, though its occasional occurrence is proved. Hess examined four cases at postmortem and determined that in every case there was infection of the vaginal portion of the cervix which, however, did not extend beyond, or in some cases, even to the external os. This condition is, strictly speaking, a cervicitis, but not an endocervicitis, and no doubt occurs more frequently than one would suppose. It is amenable to treatment by topical applications and can be favorably affected by thorough vaginal treatment, which is not the case with a true endocervicitis. I assume that the cervical glands are involved only in cases in which the infection stubbornly resists careful and thorough vaginal treatment. The presence

of mucus, especially with enmeshed pus cells, with or without Neisserian organism, is suggestive. Mucus is not secreted by the normal infantile cervix in amount sufficient to constitute a vaginal discharge. Its presence grossly or in vaginal smears, especially combined with pus, is significant of inflammation in the cervical glands. The secretion of a simple vaginitis is merely the exudate from an inflamed mucous membrane. It will vary from thin serous secretion in chronic cases to thick, purulent secretion in acute cases, but it should not contain notable amounts of mucus.

The use of a small urethroscope to examine the cervix may be of value; smears may be taken, and fair observation obtained through a number 26. If it were possible also to give efficient treatment by this means, it would constitute a definite advance. I agree that occasionally a case may seem to be cleared up by local applications to the external os. It is my experience, however, that even in parous adults, in whom the endocervix can be easily reached, local applications are especially ineffectual. There is little reason to expect any result with the tiny, tight cervices of infants and children. Moreover, in certain cases, manipulation may cause definite and permanent psychic injury. It must be remembered that a more complicated mechanism is being dealt with than in the case of examination of other parts of the child's body. The use of force is to be avoided, both because of the effect on the child, and because the treatment cannot be effectual if there is a vaginismus. Occasionally an anesthetic may be used, but it cannot be repeated often. These factors make for a more serious prognosis. In such difficult cases, it seems wiser to make a diagnosis of cervical infection by inference, from the failure of adequate vaginal treatment to control the discharge. It is my purpose to present a method of treatment sufficiently reliable to warrant such an inference. In other words, treatment of the vagina can be so efficient that if the discharge is not cleared up, it is fair to assume that the endocervix is involved, without the evidence of detailed investigation. It is understood, of course, that examination of the cervix should be made and treatment instituted whenever feasible. In this regard I refer only to patients who are difficult to examine.

If the difficulty is due to the small caliber of the hymeneal opening, the hymen should be incised before other procedures are attempted. A good sized wedge may be removed posteriorly. This is superior to a simple dilatation, because it not only removes the obstruction to instrumentation, but also improves the drainage. It will not help in cases in which the resistance is mostly voluntary, except to improve drainage. I have shown some of the types of hymen to be encountered and wish to emphasize the importance of knowing exactly the type of opening with which one has to deal. It is not enough to know merely that the

necessary instruments will pass, but one must understand clearly the position and type of opening and its relation to the proper drainage of the infected vagina.

Invasion of the mucous glands of the cervix is much more frequent in adults than in children. This may be due to several factors. The virulence of the strains infecting children is shown to be less. The lumen of the cervix is less patent, and the glands, especially in infants, have not developed the maximum racimose character. There is an absence of trauma and of repeated exposure to infection. In other words, it seems that the lower incidence of cervical infection in children is due chiefly to mechanical factors, and that there is not, as is supposed, any notable difference in the resistance of the infantile mucosa to infection.

The same principle applies to the vaginitis. I do not believe that the higher incidence of primary vaginitis in the young can be explained by an hypothetic low resistance of the vaginal mucosa. In examining sections of normal infantile vaginas, one is struck with the healthy appearance of the squamous epithelium and the generous vascularity of the papillae, as compared to that in the adult. The really striking feature in the examination of these immature vaginas is the rugose contracted condition which they present grossly in the fresh specimen and the corresponding high elastic tissue and smooth muscle content shown by van Gieson's method of staining. This contracted state is not seen in the adult, because of repeated dilatation from coitus or childbirth. An unruptured hymen serves, further, to obstruct these rugose, contracted vaginas, and all factors are present to constitute a true "harbor of infection" in which the gonococcus may find its ideal habitat. In adults, the flattened, exposed surface of the vagina offers little protection. However, in adult virginal women and in old women whose vaginas show the contraction and stasis of senile atrophy, a primary vaginitis is often found. These observations substantiate the theory that the higher incidence of primary vaginitis in children is due to the contraction and cryptic nature of the immature vagina, with consequent stasis, making it a true "harbor of infection."

TREATMENT

A rational treatment can be outlined only if this conception is kept clearly in mind. The indications are for the application of a reliable antiseptic at a correct concentration. The application must be universal, penetrative and effective over a long period. It is not so much the antiseptic as the method of application that has been at fault. Douches are ineffective, because they cannot be given under sufficient pressure to distend and penetrate all the vaginal folds. Their effect is transient. Instillations of more or less concentrated antiseptics may suffice, especially if the patient is put in the knee-chest position, and the medicine

allowed to remain in the vagina for several minutes. The use of a dye such as mercurochrome-220 soluble will prolong the effect, and will give a certain amount of penetration. In children, however, it will be noted that the contracted vaginal wall does not distend under atmospheric pressure as it does in adults, and only a partial application will be obtained. Antiseptics may be kept in contact with the vaginal mucosa for longer periods if they are incorporated in an ointment and injected.

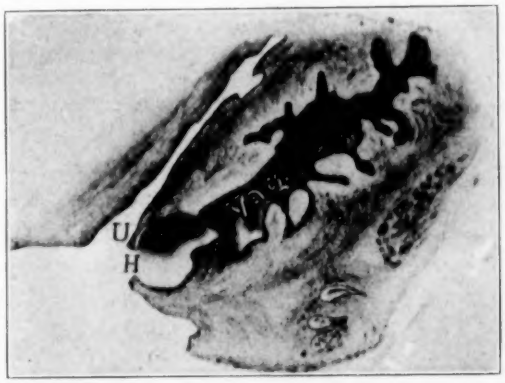

Fig. 2.—Sagittal section of the vagina of a 14 cm. embryo. The vaginal cavity has been distended and (the tissues) fixed. Ordinarily the walls would be approximated. The irregular cryptic nature of the cavity is well shown; such crypts harbor bacteria in the immature vagina (Williams' Obstetrics).

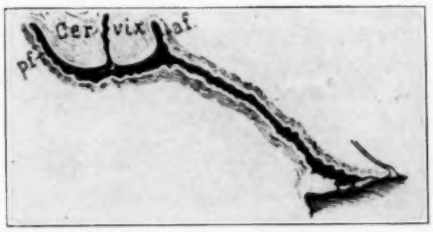

Fig. 3.—Diagrammatic sagittal section showing topography of a parous adult vagina (undistended). Note the comparative flatness and the absence of crypts and folds to harbor bacteria (Ansbach).

However, a soft base ointment of the sort generally used will melt and run at vaginal temperature, and if simply squirted at random into the vaginal cavity, cannot be expected to penetrate the folds and give a universal application. I have made postmortem examinations of four of these small vaginas, and I believe that the ordinary instillation or injection of ointment seldom applies directly to over 50 per cent of the vaginal surface. This type of treatment is as ineffectual as is the now discarded topical application to the cervix in adults, for similar reasons.

In order to meet all the indications for treatment, it is necessary to use a hard base ointment which will not melt and run freely at vaginal temperature, and still will hold its antiseptic available. This ointment must be introduced under sufficient pressure to penetrate and distend, so that it will flatten the folds and gain access to every nook and cranny. The pressure will also assist in the penetration of the medicament into the mucosa itself. Hydrous wool fat was at first used as a base and found satisfactory; anhydrous wool fat, however, proved to be more tenacious, and has the added advantage that it absorbs the moisture on the mucosa and gives the ointment an actual affinity for the tissue,

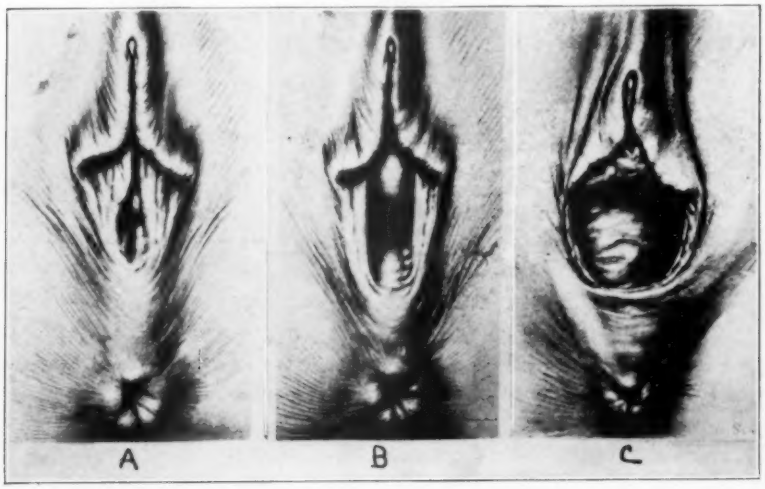

Fig. 4.—*A* shows the nulliparous introitus of a married woman. There is no actual obstruction; drainage is free. *B* shows the parous introitus with moderate relaxation and *C*, the parous introitus with considerable relaxation following a second degree tear. The vaginal wall in these cases is flattened and there is no tendency to occlusion at the outlet. Drainage is free. There are no crypts to serve as harbors for delicate organisms such as the gonococcus (Ansbach).

instead of the repulsion between moisture and the ordinary grease base. Such an ointment is found by experience to cling tenaciously, to make a direct and lasting contact and to yield the antiseptic freely to the tissues,[1] at least in the form of dyes.

1. Culver has recently reported the use of antiseptics in a solution of gelatin in the treatment of gonorrhea. The value of this over a simple water solution is obviously due to the increased viscosity which gives a certain tenacity to the application. This is true, in a greater degree, of an ointment. However, it has been shown that when the viscosity is too great, as in the case of parafin, ambrine, etc., the antiseptic is not liberated, and is valueless. This is not the case with hydrous wool fat.

The nozzle of the stock 1 and 2 ounce ointment tubes can be inserted satisfactorily in nearly every case, but the bevelled end of the tube is not adapted for use as an occlusive diaphragm against which the return flow of ointment can develop pressure. For this purpose, I use a dental molding substance ordinarily used for taking impressions. It can be warmed and molded into a flattened ovoid about the base of the nozzle shaft. The nozzle is then inserted into the vagina, and the material, which is still warm and pliable, is gently molded to fit the vulva accurately. On cooling, it becomes a thin rigid diaphragm attached to the nozzle, and can be held as snugly as necessary against the vulva without discomfort, the pressure being distributed to the surrounding pads of fat which are highly developed in infants and in children. Such

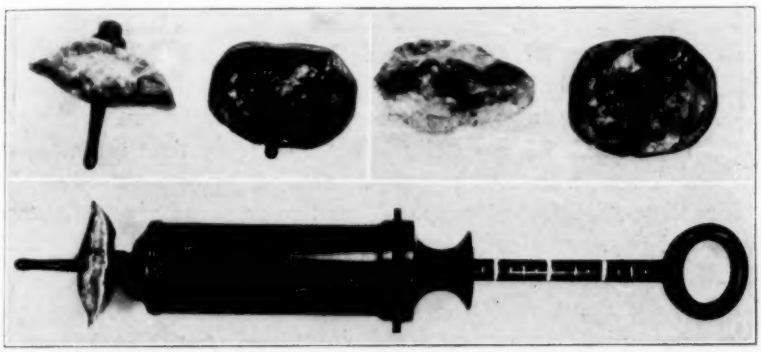

Fig. 5.—Syringe with specially adapted nozzle and occlusive diaphragm fitted for a child, 3 years of age. The handle is calibrated, and the amount of ointment injected is recorded. Two special nozzles are shown, one with the diaphragm ready to be warmed and molded, and the other already fitted.

a device, together with a hard base ointment, can be made practically occlusive against the return flow. In this way the desired intravaginal pressure can be developed.

A 4 ounce hard rubber syringe with specially adapted nozzles is used. Control of the amount of pressure is essential, and for this reason the screw plunger type of syringe was abandoned and the direct force plunger type adopted. It is important not to overdistend the vagina, because it causes pain and might possibly force infective material into the cervix. The amount of ointment injected can be accurately measured by calibration on the syringe or its handle and recorded for future treatments.

One may be sure of a successful technic if the child does not suffer from overdistention, and if the ointment gushes out freely as though under pressure when the diaphragm is withdrawn. Occasionally, it will not fit well and will allow the ointment to escape at low pressure,

or it may bear on sensitive points. This can be easily remedied by rewarming and refitting.

Gelhorn and Stein have advised the use of 1 per cent silver nitrate and 1 per cent mercurochrome in an ointment. There seems to be no chemical interaction of the two drugs. I use this combination in a base of anhydrous wool fat, often increasing the concentration of the mercurochrome to 5 per cent or more. The dye is well absorbed by the dehydrated mucous membrane, and the silver held in close approximation for a long period. The ointment will continue to appear on the pads for from twenty-four to forty-eight hours, showing that it is well retained. Care should be used not to stain the child's clothing. In one case I found a 5 per cent concentration of mercurochrome highly irritating. The duration of the treatment will depend on the severity of the case and the apparent reaction to treatment. This can be gaged by the disappearance of the vulvar irritation and of the discharge, and by continued negative smears and observation of the child's general condition. Ordinarily, it is not safe to promise lasting results if treatment is given for less than three months, especially in cases of more than three months' duration. I start with treatments every second day or more often if the discharge is not controlled early. After two weeks, I give a treatment every third day, or twice a week, provided the discharge is controlled, until the tenth to the fifteenth week, depending on the individual case. If smears are then negative, and if the patient is free from symptoms, treatment may be discontinued for a month. If relapse does not occur and the smears are negative at the end of this period, treatment is suspended indefinitely, but the patient is kept under observation if possible.

Children under 6 years of age are more amenable to treatment. The strong fear reflex connected with any manipulation of the genitalia is not developed, under this age, in any but precocious girls. As the age of puberty is approached, there is an increasing tendency for even the gentlest contact to be sidetracked from its normal path to consciousness, and to register as pain and fear out of all proportion to the stimulus. For this reason it is wise to pursue treatment vigorously in infants and younger children so that it may not be necessary to do so later, when the sensory end-organs have developed more complicated cerebral connections or have become cross-circuited with the hormone system. It is important also to keep all paraphernalia out of sight. The child will be frightened by the brandishing of instruments, and one must not forget the danger of establishing an instrumental fetish, especially in older girls. Taussig warns physicians concerning this possibility. He found that in one of his wards, three of the older girls were playing physician and pretending to treat the younger girls behind the backs of the attendants; the results may be imagined.

No one who has treated these patients and conscientiously followed the course of the disease can lay claim to unfailing success, for there are times when it is best to avoid rigorous treatment, though it may mean that the condition can only be tempered, not cured. Such stubborn and difficult cases, and certainly those in which there is any indication of a gonorrheal origin should be faithfully followed and the infection controlled. Efficient vaginal treatment will relieve the discharge and eliminate the danger of transmission to others. The case must be studied and carried along much as one handles a case in which there is a stubbornly positive Wassermann reaction. It is well to remember that the gonococcus in a given case does not retain its virulence, and can be considered to be noninfectious after a period of eighteen months at the longest. For some reason, the organisms infecting children are of a low initial virulence, and reliable authorities (Ratchford, Herrold) believe that the infection never persists after puberty. One must remain slightly skeptical in regard to the unfailing truth of these statements, but at the same time they should temper the plan of treatment. It must be borne in mind that permanent psychic harm can be done by the use of ruthless methods.

SUMMARY

1. Details and technic of a thorough study of the case are given.

2. The reason for the more frequent occurrence of a primary vaginitis in the young is shown to be due to the contracted and occluded conformation of the immature vagina, which makes it an ideal harbor of infection, and not, as was formerly thought, to an hypothetic lower resistance of the mucous membrane.

3. Failure to bear this conception in mind may account for the obvious lack of success in the treatment of patients in the past. A new method of treatment is outlined which meets the actual indications as nearly as possible.

4. A device is described by which the desired intravaginal pressure can be obtained, the crypts and rugae distended and a universal, penetrating and lasting application of the antiseptic obtained. The use of anhydrous wool fat as a base is suggested for special reasons.

5. A plea is made for a more careful consideration of the effect of strenuous measures in this type of local treatment. It is pointed out that the treatment may be made worse than the disease.

Medical Arts Bldg., Portland, Ore.

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News and Comment

PRELIMINARY REPORT FROM INSTITUTIONS FOR FEEBLEMINDED AND EPILEPTIC PATIENTS IN THIRTY-SIX STATES

On Sept. 14, 1927, the Department of Commerce made the following preliminary announcement of the results of the census of state and federal institutions for feebleminded and epileptic persons for 1926:

Complete returns have been received from thirty-six states, covering sixty, out of a total of seventy-five, state institutions for feebleminded and epileptic patients which were in operation in 1926. These sixty institutions had a total of 7,203 first admissions during the year 1926, as compared with 6,633 in 1922, or an increase of 8.6 per cent. These first admissions represent patients received during the year, who had not previously been under treatment in any institution for feeblemindedness and epilepsy.

For the thirty-six states represented, there were 7.6 first admissions per 100,000 of the general population, as compared with 7.4 first admissions per 100,000 in 1922. In other words, the number of first admissions has increased only a little more rapidly than the general population.

The extent to which provision has been made for the institutional care of feebleminded and epileptic persons is perhaps best indicated by the number of patients in the institutions on a given date. In the thirty-six states covered by this statement, the number of feebleminded and epileptic patients under institutional care shows a steady increase, as indicated by the figures for the dates at the beginning and the end of the two most recent years for which data are available, which are as follows: Jan. 1, 1922, 39,596; Jan. 1, 1923, 42,164; Jan. 1, 1926, 49,788, and Jan. 1, 1927, 52,043. The number of such patients under care per 100,000 of the general population increased from 47.0 on Jan. 1, 1923, to 54.7 on Jan. 1, 1927. For the most part the figures for the individual states show similar increases.

MEETING OF CONGRESS INTERNATIONAL de l'ENFANCE

The Congress International de l'Enfance meets in Paris, July 8 to 12, 1928. There will be five sections — those on maternity, infancy, childhood, social service and behavioristic problems. All communications should be addressed to 37, Avenue Victor-Emmanuel-III, Paris (VIII°). The secretary of the congress is Dr. Lesage.

Abstracts from Current Literature

Anatomy and Physiology

STRUCTURAL AND FUNCTIONAL PREDISPOSITION TO DISEASE. A. HYMANSON, M. J. & Record **125**:620 (May 4) 1927.

In the first years of life, the study of predisposition to disease is difficult. If one bases predisposition on anatomic differences, the rapid growth and development of this period of life interfere with the recognition of individual or group peculiarities.

The isolation of Czerny's exudative diathesis in infants was a triumph, but it is not known yet what becomes of these subjects in maturity. There is great confusion about the terms, constitution diathesis and predisposition.

Kretschmer has recently published the results of measurements of the insane subjects. He has isolated several physical types, as the athletic, the asthenic and the pyknic, which is stocky and compact, the mixed athletic-asthenic, and the dysplastic, in which there are disharmonies of endocrine origin. Of these groups, the asthenic and the endocrine types are the only ones that are recognized in childhood, and these may change in the adolescent period.

The study of heredity in the case of a young child may throw some light on its constitution, as it will probably follow one of its parents. Wunderlick has classified predisposition in two types: 1. There is the type which easily throws off all infection — this is called the strong constitution. 2. There is the type that overacts to all irritation — this is called the irritable constitution. Some authors place all conditions due to imperfect metabolism under the irritable constitution. The blood picture in the irritable constitution has not been fixed. Probably when more is known about food and its digestion, a close relationship between food and predisposition to disease will be shown.

WILLIAMSON, New Orleans.

DOES THE FETAL THYROID CONTAIN SPECIFIC SUBSTANCES? ANDREAS TANBERG, Norsk. Mag. f. Lægevidensk. **88**:692, 1927.

By feeding fetal thyroid in minute quantities to frog larvas, the author has come to the conclusion that fetal thyroid contains the specific substance but in much less quantity than a fully developed thyroid does.

TOVERUD, Oslo, Norway.

Pathology, Bacteriology and Biochemistry

THE AMYLASE-ACCELERATOR AND ANTI-TRYPSIN OF NORMAL HUMAN SERUM. CHARLES O'DONOVAN, JR., and WILBURT C. DAVISON, Bull. Johns Hopkins Hosp. **40**:238 (April) 1927.

The experiments reported confirm the presence of an amylase-accelerator in normal serum.

It was also found that heating the serum to 58 C. for thirty minutes produced a marked reduction (50 per cent) in the activity of the amylase-accelerator and of the antitrypsin.

THE PASSIVE TRANSFER OF HYPERSENSITIVITY (LOCAL AND CONTRALATERAL PASSIVE TRANSFER EXPERIMENTS). LESLIE N. GAY and ELIZABETH CHANT, Bull. Johns Hopkins Hosp. **40**:270 (May) 1927.

The authors summarize the results of their experiments as follows:

1. The sensitizing power of serum of patients having hay-fever depends on the reagin content of the serum, and not on the severity of clinical symptoms. There is not sufficient evidence as yet to conclude that by our method of treatment we fail to "desensitize" our patients.

2. Heat at 56 C. rapidly diminishes the sensitizing power of the serum. The passive transfer of hypersensitive states could not be demonstrated if serum was heated for 40 minutes at 56 C. Heat at 38 or 40 C. for thirty minutes fails to destroy completely the sensitizing power.

3. A site injected with sensitizing serum remained sensitive for at least thirty-six days, after which time the reactions became definitely smaller.

4. Second injections of atopen into sensitized areas produced a much diminished reaction in five cases, suggesting the possibility that reaction occurs only in the instance in which the primary atopens fail to combine with the reagins existing in the sensitized tissue.

5. Reactions from the injection of mixtures of serum, from individuals sensitive to timothy pollen, with timothy extract are striking and much greater than from the combination of timothy extract with normal salt solution or the combination of serum, from individuals sensitive to timothy pollen, with normal salt solution, suggesting that neutralization does not become complete until after the injection into the normal tissue.

6. We have described the direct method of passive transfer as well as the phenomenon of contralateral passive transfer. The reaction of the latter phenomenon differs strikingly from the reaction obtained by the direct passive transfer technic. Contralateral transfer depends on the concentration of the atopen; aged serum gives delayed reactions as compared with fresh serum; the reagin content of the serum must be high in order to sensitize the skin sufficiently to produce contralateral reaction, and the serum must be obtained from a patient who gives a history of severe symptoms of hay-fever or bronchial asthma. Heat at 56 C. for twenty minutes or longer retards the phenomenon of contralateral transfer.

7. We were unable to sensitize guinea-pigs with serum taken from individuals sensitive to rabbit hair or horse dander.

THE EFFECT OF THYROID FEEDING ON THE SPONTANEOUS ACTIVITY OF THE ALBINO RAT AND ITS RELATIONS TO ACCOMPANYING PHYSIOLOGICAL CHANGES. GING H. WANG, Bull. Johns Hopkins Hosp. **40**:304 (May) 1927.

Desiccated thyroid gland was fed to albino rats, and observations were made on the total metabolism of the animals and their spontaneous activity was measured.

It might be expected that bodily activity would increase on thyroid medication. These experiments show, however, that the activity level remains low as long as the thyroid extract is administered. There was an increased intake of food and water, increased pulse rate and body temperature and decreased body weight.

The author suggests as a likely explanation that the thyroid feeding may render the animal more susceptible to fatigue. The greater metabolism requires that the heart circulate the blood more rapidly in order to supply sufficient

oxygen for the burning process. Muscular activity increases these demands, so a stage is reached where more oxygen is required than the heart can supply. Waste or fatigue products accumulate, and the animal is unable to run.

LYTTLE, New York.

PHYSIOLOGICAL EFFECTS OF DIETS UNUSUALLY RICH IN PROTEIN OR INORGANIC SALTS. T. B. OSBORNE, L. B. MENDEL, E. A. PARK and M. C. WINTERNITZ, J. Biol. Chem. **71**:317, 1927.

The blood of rats on a protein-rich diet has a somewhat higher content of nonprotein nitrogen than is normal. The kidneys become hypertrophied, but the urine shows no abnormalities indicative of chronic renal disorders attributable to the protein. The feeding of urea in amounts equivalent to that derived from effective quantities of protein fails to bring about an equally noticeable renal enlargement.

A BIOCHEMICAL STUDY OF TOOTH GROWTH. Y. MATSUDA, J. Biol. Chem. **71**:437, 1927.

The lower incisor of the rat is longer, heavier, has a thicker enamel, a greater percentage of ash constituents and a lower percentage of water than the upper incisor. The teeth of the young rat are smaller and contain a lower percentage of ash constituents and a greater percentage of water than the teeth of the older rat. The ash of the lower incisor has a higher percentage of calcium and a lower percentage of magnesium than the upper, but does not differ in the percentage of phosphorus. The ash of the young tooth contains a lower percentage of magnesium than the old tooth but does not differ in the percentage of calcium and phosphorus. Teeth differ from bone in that the calcium and phosphorus of the ash do not change with age.

(No correlation is made of the variation in magnesium content with structure. It may be significant that in the young tooth and in the lower incisor where the magnesium content of the ash is least, the enamel volume tooth volume ratio is greatest.) LOCKE, Chicago.

COD LIVER OIL CONCENTRATE. ITS VALUE AS AN ANTIRACHITIC AGENT WHEN INJECTED SUBCUTANEOUSLY. B. KRAMER, S. D. KRAMER, D. H. SHELLING and M. J. SHEAR, J. Biol. Chem. **71**:699, 1927.

A cholesterol-free concentrate prepared by the method described was found to be as potent as cod liver oil itself in amounts equivalent to the original oil. The concentrate, when injected subcutaneously in an ether solution, cured rats of experimental rickets. The same concentrate is inactive when injected subcutaneously with palmitin as the solvent. AUTHORS' SUMMARY.

THE INTRACELLULAR PROTEINS OF BACTERIA. 2. THE GLOBULINS AS INDICATORS OF INTERSPECIES RELATIONSHIPS. CASPER I. NELSON, J. Infect. Dis. **40**:412, 1927.

Globulin obtained from seven species of the colon-typhoid group of bacteria were effective antigens for the production of precipitins in rabbits. These globulins are highly specific for their homologous antiserums. They also possess a specificity for heterologous serums which is quantitatively proportional to the genetic relationship which the heterologous derivative bears to

the homologous one. The data of complete direct and cross precipitin titrations of the bacterial globulins and their antiserums, when analyzed objectively and statistically, yield a sequence of interspecies relationship about as follows:

Group A 1. *B. typhosus*
2. *B. paratyphosus* A
Group B 3. *B. paratyphosus* B (Aertrycke type)
4. *B. enteritidis*
Group C 5. *B. coli*
Group D 6. *B. dysenteriae* Flexner
7. *B. dysenteriae* Shiga

This is quite in agreement with the latest opinions concerning the host distribution of this group. Two distinct groups of organisms are recognized, the dysentery group and the typhoid-paratyphoid A group. There is a third less well defined group, the enteritidis-paratyphoid B group. A fourth group is represented by *B. coli* which is linked in a fundamental way with all the other organisms and particularly with the dysentery group. *B. coli*, genetically speaking, is a stem organism.

AUTHOR'S SUMMARY.

EFFECT OF GENTIAN VIOLET AND MERCUROCHROME ON ENDOMYCES ALBICANS. ESTHER BRIDGMAN CLARK, J. Infect. Dis. **40**:423, 1927.

Gentian violet completely inhibits the growth of the mycelial and yeast forms of endomyces albicans in dilutions up to 1:100,000, and inhibits to some extent in dilutions to 1:400,000. A dilution of 1:10,000 of mercurochrome-220 soluble causes no inhibition in the growth of the mycelia of yeast forms of endomyces albicans.

AUTHOR'S SUMMARY.

FOOD ACCESSORY SUBSTANCES (VITAMINS) AND THE TUBERCLE BACILLUS. NAO UYEI, J. Infect. Dis. **40**:425 and 433, 1927.

Tubercle bacilli fail to grow when seeded with suspensions containing 10 mg. or less of young active bacilli per cubic centimeter, while a suspension containing 50 mg. or more per cubic centimeter grows in Long's synthetic medium containing 2.5 per cent agar. On egg mediums growth occurs at lower concentration of suspensions of the bacilli. All attempts to demonstrate the presence of a growth stimulating substance or substances in the cell of tubercle bacilli or in their metabolic products in the form of old tuberculin failed. These results seem to indicate that the "bios" theory of Wildiers for yeast is not applicable for tubercle bacilli as an explanation of their failure to grow when thinly seeded on artificial mediums.

Cod liver oil concentrate ("Oscodal" of Funk and Dubin), known to be rich in fat soluble A vitamin and the antirachitic vitamin, exerts an indifferent action on the growth of tubercle bacilli. Conforming with the results of other investigators with other bacteria, substances rich in vitamin B, namely, Harris' yeast vitamin, orange juice, tomato juice and cabbage juice, exert a pronounced stimulating effect on the growth of tubercle bacilli. With the technic used in these studies, the acceleration of growth is easily discernible in concentration of 1:1,000 for Harris' yeast vitamin, 1:100 for tomato juice and orange juice and 1:20 for cabbage juice.

AUTHOR'S SUMMARY.

EFFECT OF BACILLUS ACIDOPHILUS ON INTESTINAL PUTREFACTION AND INDICAN OUTPUT. M. KAHN, J. Lab. & Clin. Med. **12**:226, 1926.

After ingestion of *Bacillus acidophilus* for from three to five days, this organism can be found in the feces in large numbers if the culture is given to the patient together with lactose; and in smaller numbers if given by itself. With the appearance of the micro-organism in the feces, the output of urinary indican decreased in most cases, indicating a decrease in the extent of intestinal putrefaction. There is evidence which seems to show that in the formation of the ethereal sulphates, two opposite effects occur in connection with the ingestion of *Bacillus acidophilus;* a decrease of the "intestinal" ethereal sulphates, caused by the decrease of intestinal putrefactive processes, and an increase of the "metabolic" ethereal sulphates, caused by lessened formation of indican.

LEVISON, Chicago.

CALCIUM METABOLISM AND THE PARATHYROID GLAND. C. F. DAVISON, Northwest Med. **26**:181, 1927.

For many years it has been known that the removal of the parathyroid glands caused a lowering of the calcium content of the blood and consequently many convulsive or spasmodic disorders. Collip, in 1924, produced an extract which will raise the serum calcium, whether it be low or normal, and has been able to standardize a unit of dosage. Overdosage causes vomiting, later, diarrhea and collapse; when overdosed, dogs will show congestion of the gastric and intestinal glands. In the terminal picture of overdosage, the serum calcium again falls, the phosphorus rises, and the kidneys cease to function.

Calcium is present in the blood in an ionized form, small in amount, but in equilibrium between the calcium phosphate of the tissues and an organic form in the serum which is not ionized. Parathyroid administration causes the ionized calcium to increase at the expense of the organic nonionized calcium. Parathyroidectomy displaces the equilibrium in the other direction. It is possible that at a certain level calcium is withdrawn from the tissues. Calcium administered as such may prevent or relieve spasmodic disorders that arise in such instances.

Calcium disturbances may arise from intoxications and from endocrine disorders. The administration of some factor such as is present in cod liver oil or in ultraviolet rays also affects the calcium regulatory mechanism. The presence of such a factor is necessary though the parathyroids are functionally normal.

Adults need 1 Gm. of calcium oxide a day, and children twice as much. This is adequately provided for if the patient takes 1 pint of milk per day. An excess of dietary calcium is not only harmless, but desirable.

SCOTT, Philadelphia.

PROTECTION OF INSULIN AGAINST ENZYME ACTION BY THE USE OF SAPONIN. L. LATSCH and S. BRÜGEL, Biochem. Ztschr. **181**:109 (Feb. 8) 1927.

The authors found that the destructive action of pepsin and trypsin in vitro can be prevented by the addition of small amounts of saponin. Inactivation of two and a half units of insulin by 0.25 cc. of a 1 per cent solution of trypsin or pepsin, was prevented by the addition of 10 mg. of saponin. Hypoglycemia following the subcutaneous injection of the test solutions in guinea-pigs and dogs was the criterion of activity. The experiments were accurately controlled. The successful oral administration of insulin and saponin to man, as judged by the hypoglycemic effect, is detailed in another article.

Optimal Dosage of Iron Oxide for Effect on Metabolism, G. Rosenkranz, Biochem. Ztschr. **185**:321 (June) 1927.

Two series of dogs on a balanced diet were given an additional 2.5 and 5 mg. of iron oxide per kilogram, respectively. The results in the two series were practically identical. Compared with a control series, the following were noted: improved intestinal absorption, increased resorption of carbon and nitrogen, diminished protein oxidation and diminished ratio of carbon to nitrogen in urine.

Brahdy, New York.

Nutrition

The Case of the Breast and Its Complications During Pregnancy. P. J. Carter, Am. J. Obst. & Gynec. **14**:81, 1927.

This paper deals only with the normal breast and the complications to which it is subject. The author condemns all procedures such as massage, oiling, bandaging and tight brassieres during the prenatal period. He makes an exception to the cases of inverted nipple that persist during the last six weeks of pregnancy. He advises pulling out of the nipple between the thumb and fingers daily.

The treatment of the postpartum breast depends on cleanliness and support. In the event that a crack or fissure appears in the nipple, the most satisfactory treatment in his hands has been 2 per cent resorcinal ointment, to remain continuously except at nursing time. If the breasts become caked, a 12-inch linen binder is applied, padding the breast with cotton so that they are lifted upward and inward. If this postural treatment is insufficient, hot stupes and ice bags are resorted to. The fomentations are continued if infection becomes evident. In the event that an abscess forms, an incision is made from the nipple to the base, and the partitions between pus pockets are broken down.

Allen, Chicago.

The Influence of the Administration of Cod Liver Oil to the Mother on the Development of Rickets in the Infant. A. A. Weech, Bull. Johns Hopkins Hosp. **40**:224 (April) 1927.

Different groups of negro mothers with nursing infants were fed varying amounts of cod liver oil during the period of lactation, and the incidence and degree of rickets in the different groups were compared.

Clinical signs of rickets were noted, but the roentgen-ray and blood chemistry examinations were considered more important.

It was not possible to show that the administration of cod liver oil to the mother is a satisfactory method of preventing rickets in the infant. The results do indicate that when cod liver oil is given to a mother, a certain amount of the antirachitic vitamin does pass into her milk. This may be insufficient to prevent manifestations of the disease but will raise the calcium-inorganic phosphorus product of the blood serum and will lessen the roentgenographic evidences of disease.

Lyttle, New York.

Overfeeding with Milk ("Milchnahrschaden" "Bilanzstorung"). Lewis Webb Hill, M. Clin. N. Amer. **10**:1339 (March) 1927.

This type of nutritional disturbance is brought about by a diet which is usually adequate as regards calories, but in which there is a faulty ratio between the food elements, in that it contains relatively too much fat and protein

and too little carbohydrate. The infant suffering from this disorder first shows a stationary weight, and later an actual loss which in some instances is large and rapid. The stools contain a large amount of calcium soap, and absorption of fat and calcium is considerably lower than normal. The pathogenesis is not entirely clear, but it seems probable that with a diet low in carbohydrate and relatively high in fat and protein, the carbohydrate, especially if it is one of the dextrin-maltose preparations, is absorbed before it reaches the large intestine, and a putrefactive rather than a fermentative flora is established in the colon. Peristalsis is slowed, and the alkaline reaction of the contents of the large bowel favors the formation of insoluble calcium soaps from the large amount of unabsorbed fatty acid and calcium present. Under the influence of putrefaction, bilirubin is reduced to colorless hydrobilirubin, and the stools become light in color.

Treatment is based on these etiologic considerations. Fat and protein are reduced, and somewhat more than the usual amount of carbohydrate is added. Lactose is the best form of sugar to use since its slow absorption allows a residue to reach the large intestine favoring the establishment of a predominant fermentative flora in this region. Experience has shown that moderate amounts of starch and a malt preparation, such as malt soup extract, are valuable additions to the diet.

This disorder will not develop if a proper ratio between protein-calcium and carbohydrate is maintained. There is no danger of giving an infant too little protein in any ordinary milk mixture. There is more chance of giving too much, and a good rule to follow is never to give more than 2 ounces of milk per pound of body weight, and usually to keep well below this in feeding infants over 6 months of age.

SMITH, Ogden, Utah.

THE GROWING TENDENCY AMONG MODERN MOTHERS TO FEED THEIR BABIES ARTIFICIALLY. CHARLES LARKIN, M. J. & Record **125**:625 (May 4) 1927.

Among the so-called upper classes there is a growing demand on the physician to put the new-born child on the bottle and dry up the mother's milk. This is done not because the modern mother cares less for her child but because times have changed. The mother no longer lives the quiet, humdrum life in her home but leads a more active and exciting life and her milk supply is therefore irregular. The modern pediatrician has mastered the art of feeding by well-balanced formulas containing all the food elements required. They have exploded the myth that mother's milk is in itself the ideal food by proving that breast-fed infants need the addition of vitamins to their diet. There is a growing tendency among pediatricians to give the artificially fed child more solid food. In fact, some are giving the infants, aged 3 and 4 months, three meals a day consisting of chopped meat, white and green vegetables, gruels, etc., and these infants are doing better than the breast-fed child. The mothers know that science has outdone nature in the art of feeding and are willing to give up the job into the hands of science.

INCIDENCE OF RACHITIS IN BREAST-FED INFANTS. CLARENCE A. MACHE, M. J. & Record **125**:625 (May 24) 1927.

The author chose fifty healthy breast-fed infants (the majority of them were colored) to study in order to find the incidence of rickets among them. He kept them under observation for three months. They were weighed and examined in their homes. After six examinations were made, they were examined finally. The mothers were given instructions concerning hygiene and were given a prescribed

diet. They were furnished condensed milk to use with this diet. Mache submitted the following observations:

1. A substantial increase in weight in all the cases.
2. An increase in quantity of breast milk and variation in the increase of proteins, carbohydrates and fat.
3. In 58 per cent of the cases, evident manifestations of rickets were shown and in 12 per cent slight symptoms were seen.
4. A gain in measurement of the head.
5. The slow process of rickets, shown by inability to improve clinical signs by cod liver oil in all the cases.
6. The prevailing opinion of a nutritional cause of rickets is questionable.
7. Galactagogue value of condensed milk is shown by the increase in carbohydrate, protein and fat content of breast milk.

WILLIAMSON, New Orleans.

ON THE ESTIMATION OF THE SECRETION OF MILK BY THE NURSING MOTHER. T. ABRAMSON, Rev. franç. de pediat. **2**:758, 1926.

This work confirms the observations of Moll, published in 1924, which were to the effect that there exists a definite relationship between the temperature of the mammary gland and its functional state. Dr. Abramson feels that in any case in which there is a question of the sufficiency of the milk, the temperature obtained by placing the thermometer beneath the breast should be compared with that obtained in the axilla. If there is a difference of 0.3 C. or more one may be sure that there is sufficient secretion. If there is no difference or the temperature is higher in the axilla than under the breast, one may conclude that the mother is unable to nurse her child. An increase of 0.2 C. or less is inconclusive, and one must resort to other methods of determining the amount of milk available.

VITAMIN STUDIES IN PORTO RICO. D. H. COOK, Porto Rico Health Review **2**:1927, 1927.

Working experimentally with rats, it was found that the platano or cooking banana is an excellent source of vitamin A, being equal to tomatoes, green peas and the yellow sweet potato. The yellow yautia contains about half as much, while the white contains very little. In regard to vitamin B, the yellow yautia ranks first comparing with spinach, the white has half as much and the platano comes last with a vitamin B content about equal to that of carrots or white potato.

LESLIE, Chicago.

EFFECT OF MEAT ON THE METABOLISM OF RATS FED WITH FAT. T. HONDA, Biochem. Ztschr. **185**:173 (May 25) 1927.

Metabolism of rats on a restricted diet of fat is lower than when on a mixed diet. The specific dynamic action of meat was demonstrated on rats that were fed a mixed diet. When the same rats had been fed an exclusive diet of fat, the specific dynamic action of meat was absent. The author considers that the abscence of action is due to the production of a fatty liver.

BRAHDY, New York.

THE INFLUENCE OF MILK SOURED WITH LACTIC ACID UPON BACTERIAL GROWTH. KARL MOSSE and HEINRICH HAPPE, Monatschr. f. Kinderh. **36**:1, 1927.

There are three dangers to the nursling in milk that has been contaminated with bacteria: (1) Contamination with pathogenic organisms; (2) contamination

with saprophytic organisms which might take on pathogenic properties, and (3) contamination with saprophytic organisms which produce injurious substances by their growth in the milk.

The most common contamination is of course that of the colon bacillus. The studies of Moro and later Bessau lay great emphasis on the presence of *B. coli* in the duodenum as a cause of diarrheal disease. The later studies of Plonsker and Rosenbaum have shown *B. coli* to be present in the stomach. Whether this is an extension upward from the intestine or whether, as Catel believes, these organisms are contained in contaminated food is still a disputed question. Another point of view is that of Adam, who believes that diarrheas are caused only by a certain strain of the colon bacillus.

Other observers attribute pathogenic properties to the enterococcus and *bacillus lactis aerogenes.*

It was Bokay who first called attention to the metabolic products of bacteria as being responsible, and he studied particularly the volatile fatty acids, as Bahrdt and Bamberg did later.

Many observers claim that sour milk is easier to digest than fresh milk. The author now asks the question whether the advantage of the sour milk is due purely to its digestibility or to the fact that the acids produced in the fermenation render it sterile.

Experiments were made by inoculating milk mixtures with huge doses of various organisms and determining the amount of acid produced and the effect of this on bacterial growth. The results show that at a p_H varying from 4.8 to 4.2 there was little effect on bacterial growth. Indeed, the gram-negative flora, such as the lactis-aerogenes group took precedence over the gram-positive organisms and thrived beautifully. Certainly lactic acid milk with a p_H of 4 is not disinfected for massive doses of bacteria. It was only by adding 1.3 per cent lactic acid and bringing the p_H to 3.6 that the milk could in any way be sterilized, but such a mixture is too sour for the infant's taste. The author did find, however, that certain organisms, such as the colon bacillus, the hemolytic streptococcus, enterococcus and typhoid bacillus, were suppressed. Other organisms such as anaerobes, lactis aerogenes and ordinary air streptococci were not influenced.

CONCERNING CALCIUM AND MAGNESIUM METABOLISM IN RICKETS. WILFRID SCHULER, Monatschr. f. Kinderh. **36**:25, 1927.

In an extensive research on an infant, aged 14 months, with healing rickets, the daily calcium retention averaged 0.523 Gm. calcium oxide, and a magnesium retention of 0.229 Gm. calcined magnesia. Apparently, then, calcium and magnesium are not antagonistic to each other.

GERSTLEY, Chicago.

CHANGES IN THE NATURE OF BREAST MILK DURING THE LAST STAGE OF LACTATION. S. ISODA, J. Pediat., Tokyo **321**:251 (Feb.) 1927.

The author studied the constituents of breast milk during the last stage of lactation and found that in general protein was increased, and that casein and globulin often far exceeded lactalbumin. Residual nitrogen was increased, resembling that of the milk at the beginning of lactation. The amount of total nitrogen was not necessarily the same as that of residual nitrogen. Hemolytic complement could not be demonstrated as it could at first. Hemolytic medium was variable, but when it was demonstrable, its hemolytic value was higher

than that of mature milk and lower than that of the first milk. The agglutination titer was higher than that of mature milk and that of the serum titer of the same woman.

THE NATURE OF MILK FAT. S. ISODA, J. Pediat., Tokyo **321**:269 (Feb.) 1927.

The author measured the four constant numbers of fat, namely: (1) iodine number, (2) Hehner's number, (3) Reichert-Meissl's number and (4) saponification number, in the fat of cow's, goat's and human milk. As it is well known, the iodine number indicates the quantity of unsaturated fatty acids, which in the human milk was 41.2 in average, while it was 37.3 in cow's milk, 32 in goat's milk and 30.5 in dried milk. Hehner's number signifies the number of grams of higher fatty acids, not soluble in water. It was high in goat's milk (83.6), and low in human milk (79.6). The Reichert-Meissl's number indicates the amount of lower volatile fatty acids, and it was low in human milk (6.7) and high in dried milk (28.6). Cow's and goat's milk were alike (24.2 and 27.7 respectively). The saponification number shows the amount of glyceride, which was the highest in the cow's milk (202.2), while it was the lowest in the human milk (173.5).

INFLUENCE OF DIET ON THE REACTION OF URINE AND FECES IN INFANTS. TAKETO TAMA, J. Pediat., Tokyo **323**:480 (April) 1927.

The author studied the effect of varying diets on the hydrogen ion concentration of urine and feces in infants fed both naturally and artificially. He concludes the study with the following summary: 1. As shown by the observations of Ylppö, the feces of breast-fed infants has a greater acidity than the urine, whereas this relationship is reversed in artificially fed infants. 2. When the sugar and protein percentage approaches that of mother's milk, the feces has a greater alkalinity than the urine. 3. This holds true when the infants are fed with a calcium caseinate, or when they are fed with carbohydrates. 4. When a large amount of malt soup extract is added to the diet, the urinary reaction approaches alkalinity, but there is no change in the fecal reaction. 5. When a solution of "galactosan" and malt soup extract is given, the urine, but not the feces, tends to become alkaline. 6. When malt soup extract is added to carbohydrates, the feces become acid and the urine alkaline, resembling that of breast-fed infants. 7. When 3 Gm. of ash from cow's milk is fed to breast-fed infants, the p_H of feces tend to become alkaline while that of the urine either is stationary or tends to become alkaline. When the whey of cow's milk is given, the fecal p_H approaches alkalinity, but the urinary p_H approaches acidity. When "galactosan" or calcium caseinate is given, there is little change in breast-fed infants, but in infants fed on 0.2 cow's milk with from 7 to 8 per cent lactose, the p_H of both feces and urine tend to become alkaline. 8. When 3 Gm. of ash from human milk is fed to breast-fed infants, the p_H of feces approaches alkalinity more than that of urine. When 3 Gm. of salt mixture devised by McCollum and Simonds are given, the p_H of feces approaches alkalinity more than that of urine. It appears, therefore, that the fecal p_H is more acid than the urinary p_H in breast-fed infants because in human milk there is a smaller quantity of salts, a greater quantity of lactose and probably a lesser amount of protein than in cow's milk. These facts explain why the curves of fecal and urinary p_H cross when artificially fed infants are fed on breast milk, and vice versa.

KATO, Los Angeles.

Prenatal Conditions

CONGENITAL DIAPHRAGMATIC HERNIA WITH A REPORT OF SEVEN CASES WITH AUTOPSIES. ARTHUR S. UNGER and MORTIMER D. SPEISER, Am. J. Roentgenol. **15**:135 (Feb.) 1926.

Arnsparger found that before 1908 only ten cases of congenital diaphragmatic hernia were diagnosed during life, although in 1899 Grosser compiled a series of 433 cases, of which 232 were demonstrated as congenital. The varieties are: (1) false hernia, in which the hernial contents pass directly through the opening, (2) true hernia in which there is a definite sac, usually of pleura and peritoneum, which precedes the hernial contents into the thorax and (3) diaphragmatic eventration or unilateral elevation of the diaphragm. The false hernia usually passes through the foramen of Morgagni, the foramen of Bochdalek, the sympathetic nerve foramen or the hiatus esophagus. Eppinger summarizes the etiology of congenital hernia as embryologic defects, excessive size of the natural foramina and weakness of the muscular layers. All viscera except genitalia, bladder and rectum have been found within the thorax. The symptoms depend on the organs involved. Differential diagnosis between eventration and hernia is made by roentgenograms. In eventration the dome of the diaphragm is pushed into the chest cavity even up to the level of the second intercostal space, and this remains regular in outline and does not show a defect, as it moves evenly with respiration. Patients with this condition are divided into three groups, those who die at birth, those who live a few months or years, but in impaired health, and the adult who may go through life and die of some remote disease. In the last group the condition is found by accident in roentgenograms or at autopsy. Minute case reports with symptoms and autopsy observations are given.

COMPLETE BILATERAL DUPLICATION OF URETERS AND RENAL PELVES. JOSEPH T. MCKINNEY and SAMUEL B. CARY, Am. J. Roentgenol. **15**:149 (Feb.) 1926.

Study of forty cases of complete bilateral duplication reported shows that fourteen were discovered at autopsy, seventeen at operation, and only nine by cystoscopy and pyelography. Sodium iodide was injected into a white female with vesical irritation, which did not improve with treatment. The left double ureters ran parallel from a double pelvis, and one of the right ureters crossed the other at two points, but the course from the double pelvis was otherwise normal.

STULIK, Chicago.

SCAPHOCEPHALY: OXYCEPHALY AND HYPERTELORISM. A. G. OGILVIE and M. M. POSEL, Arch. Dis. Childhood **2**:146 (June) 1927.

A case of scaphocephaly and two cases of oxycephaly are described. In the scaphocephaly, the greater wings of the sphenoid were underdeveloped; this was confirmed at autopsy. In the cases of oxycephaly (mother and daughter), the greater wings of the sphenoid were grossly enlarged. The poor development of the greater wings brought about a narrowing of the whole skull, especially the anterior part, producing the elongation of the skull and the elevation of the vault with absence of frontal and parietal eminences. The enlarged, solid greater wings of the sphenoid in oxycephaly push the temporal bones laterally, leading to temporal bulging, with an increase in the transverse diameter and wide shallow orbits; the occiput comes forward, cramping the base, crowding the foramina and shortening the anteroposterior diameter. The consequence is the great increase of height. Both deformities are associated with total absence of sutures.

PETERMAN, Milwaukee.

Diseases of the New-Born

CONGENITAL ARTESIA OF JEJUNUM (RECOVERY). G. BRUTON SWEET and ROBERTSON, Arch. Dis. Childhood **2**:186 (June) 1927.

Gastro-enterostomy with later entero-enterostomy was done in an infant, aged 10 days, with congenital atresia of the jejunum. The infant recovered.

BIRTH INJURY. E. MARTIN, Monatschr. f. Geburtsh. u. Gynäk. **76**:7 (March) 1927.

Ten days after birth, the mortality in 8,812 infants was 241, or 2.7 per cent. Of these, 112, or 64.4 per cent, were not viable, weighing less than 2 Kg. Of the remaining infants, 1.17 per cent of the deaths were due to injury to the head. Seven hundredths per cent of the deliveries were normal, and 1.1 per cent instrumental. Martin favors conservative obstetrics.

PETERMAN, Milwaukee.

Acute Infections

VACCINATION OF PREGNANT WOMEN. B. L. LIEBERMAN, Am. J. Obst. & Gynec. **14**:217, 1927.

Vaccination of the mother against smallpox during pregnancy did not seem to convey a specific immunity in the infants in a series of 351 cases observed by the author. Any immunity that was present was insufficient to afford protection even from vaccination. None of the infants vaccinated showed any undue symptoms or effect in their future welfare.

ALLEN, Chicago.

POSTINFLUENZAL BRADYCARDIA. ALBERT S. HYMAN, Arch. Int. Med. **40**:120 (July) 1927.

Slowing of the pulse rate during the course and convalescence of certain acute infectious diseases, such as typhoid fever and certain types of pneumonia, has been a clinical observation for many years.

A definite type of bradycardia associated with certain irregularities of rhythm was discovered by the author in a recent study of postinfluenzal disturbances of the heart and postinfluenzal heart block, and though apparently common, this phenomenon has not been discussed in the available literature; in view of the apprehension caused by bradycardia when detected, as well as its frequency, the author was prompted to a closer investigation of these bradycardial irregularities.

In this study, when the previously known pulse rate has been higher, a rate of 60 beats a minute or lower has been used in determining cases for investigation. The author states that altogether seventeen patients have been carefully examined and followed and cites six patients ranging in ages from 11 to 61 years. The graphic electrocardiograms are reproduced, and a short history of the case and a complete analysis of the charts accompany the reproductions.

The author states that "simple" postinfluenzal bradycardia is probably the result of direct poisoning of the pacemaker mechanism of the heart by bacterial toxin. A depression of the sinus node, with its specialized cells for impulse production, develops so that there is a retardation or interference in the normal release of the stimulus necessary for exciting the cardiac contraction cycle. It is suggested that this is not purely a vagal phenomenon and the result of toxic stimulation of the autonomic system because other vagal effects are not noted in the patient.

Three degrees of depression of the sinus node seem to occur. The case cited, that of a boy, aged 11, is typical of the first degree, which consists of a simple slowing of the pulse rate to about 60 beats a minute, when the previously normal rate has been from 74 to 88.

The second degree of depression of the pacemaker mechanism produces a bradycardia of from 40 to 50 beats a minute with an irregularity which in many respects clinically suggests an extrasystole, but which on instrumental investigation is discovered to consist of escaped nodal beats. Further depression apparently results in the escape of more such beats, to the extent that every other impulse may be so produced. Three cases are given as illustrative of this type. The third degree of nodal depression is so extreme that the Gallavardin phenomenon of independent ventricular rhythm occurs with an irregularly slow pulse of from 28 to 38 beats a minute. Two cases are given to illustrate this type.

The clinical importance of detecting this condition cannot be overemphasized, for it may be readily confused at the bedside with partial and complete heart block associated with extrasystoles.

Prognosis in the second and third degree must necessarily be guarded and the patient's activities closely supervised, while the outlook in toxemic nodal depression, that is, in the first degree, is apparently good, with complete recovery of the cardiac condition expected.

The differential diagnosis of such clinically similar cardiopathies may be extremely difficult and at times impossible. For this reason it may be suggested that all bradycardial irregularities, more especially those following acute infectious diseases like influenza, should be investigated by electrocardiographic and polygraphic studies to determine the true condition of the cardiac mechanism. In this way, the number of sudden deaths and other cardiovascular accidents which seem to be increasing daily may, perhaps, be avoided.

LOEBER, New Orleans.

THE USE OF MERCUROCHROME-220 SOLUBLE IN CHILDREN. HARRY LOWENBERG, Arch. Pediat. **43**:244, 1926.

The author reviews briefly the reports of others using this drug and the conditions for which it was used. His own experience with it has been in cases of endocarditis and pericarditis with effusion; tuberculous meningitis; pneumococcic meningitis; osteomyelitis; pneumococcic and streptococcic peritonitis; epidural spinal staphylococcic abscess; erysipelas; empyema; gonorrheal vaginitis. His opinion of the drug is, in general, not favorable, and he believes that those who are ardent advocates of it have become over enthusiastic.

SCHLUTZ, Minneapolis.

SCARLET FEVER CONTROL. JAMES E. DYSON, J. Iowa M. Soc. **17**:201 (June) 1927.

Dr. Dyson reviews the literature on the use of scarlet fever toxin which has been detoxified with sodium ricinoleate and gives a report of his own cases, numbering seventy. He reports reaction, redness and swelling of the arms, and concludes that the reaction to the inoculation is not severe enough to prevent the general use of the drug.

The high percentage of negative Dick tests six months and one year after these inoculations would indicate a fairly lasting immunity.

SCARLET FEVER PREVENTION BY BIOLOGICALS. DON M. GRISWOLD, J. Iowa State M. Soc. **17**:227 (July) 1927.

When the infectious agent of scarlet fever was isolated and a soluble toxin extracted therefrom, a tremendous stride was made in the knowledge of the prevention and treatment of this disease. In reading and interpreting the Dick test, one must always lean liberally toward the side of calling questionable reactions positive and advising immunization. The author considers all children under high school age who have not been known to have the disease as susceptible to the disease and immunizes them. We have used this procedure in the institutions in Iowa that care for children with marked success.

We have been recommending 45,000 skin test doses of the toxin given in five doses at intervals of one week. More recent investigation seems to indicate that from 65,000 to 90,000 skin test doses should be used. To avoid reaction, not more than 500 skin test dose should be given at the first dose. The reaction shown is similar to a mild form of the disease, but it is noninfectious. The author has not had much experience with recinoleated antigen.

Antitoxins prepared by houses manufacturing biologic products may be utilized in tests as a preventive and a treatment. In speaking of the therapeutic use of scarlet fever antitoxin, the author can hardly use words to give sufficient praise. Toxic forms of scarlet fever, in which the patients are severely ill, respond almost like magic to the administration of adequate doses of scarlet fever streptococcus antitoxin.

The author has not seen any evidence that the infectious period is shortened by the use of the antitoxin. He feels that if a larger proportion of the population is made immune to scarlet fever, the number of immune carriers will probably be increased.

TURNER, Des Moines.

THE USE OF A MIXED VACCINE IN THE TREATMENT OF PERTUSSIS. EDWIN P. RUSSELL, J. Michigan M. Soc., Battle Creek Sanitorium Bull. **22**:170 (July) 1927.

In thirty-six patients with pertussis treated with combined commercial vaccine, improvement was noted in thirty-three. The dosage for patients over 1 year was 0.25 cc., increasing by 0.2 cc. for each injection. In patients under 1 year, 0.2 cc. was the initial dosage, increased by 0.15 cc. Injections were given forty-eight hours apart. At least three injections usually were required in the older group, and a still greater number in infants. Complications did not occur in the thirty-six cases in which this treatment was given.

SANFORD, Chicago.

EFFECT OF BLOOD TRANSFUSIONS IN CERTAIN STREPTOCOCCIC INFECTIONS. FRANK C. NEFF, Southern M. J. **20**:519, 1927.

The repeated transfusion in infants and older children suffering from a hemolytic streptococcic infection of the blood stream appeared to be of definite benefit. The intervals between injections should probably be three or four days, and the phagocytic and protective activity of the donor's blood should be enhanced by vaccination.

SCHLUTZ, Minneapolis.

RELATIONSHIP BETWEEN SCARLET FEVER AND CHRONIC NEPHRITIS. GRANT CAMPBELL, Canad. M. A. J. **17**:779, 1927.

Dr. Campbell reviews briefly some of the current teachings in regard to the relationship between scarlet fever and chronic nephritis. The present study was

undertaken to demonstrate the actual relationship from the standpoint of a clinical and statistical study. The following conclusions were reached:

1. The incidence of acute nephritis in scarlet fever in Montreal during the past twenty years is less than 3 per cent.

2. In a study of 10,000 cases of scarlet fever at the Alexander Hospital, only 22 per cent of the patients developed nephritis. Almost all responded rapidly and left the hospital without any clinical evidence of involvement of the kidneys. There were 6 deaths out of 231 cases of nephritis in a group of 10,265 cases of scarlet fever.

3. A statistical study based on the records of the Montreal General Hospital and the Montreal Maternity Hospital shows, in general, a hospital group of 1,500 consecutive cases. There was a history of scarlet fever in 121; a history of nephritis in 92, and a history of both in 10.

In the group from the Maternity Hospital (1,500 cases) there was a history of scarlet fever in 192; a history of nephritis in 40 and a history of both in 10. This would indicate that the incidence of chronic nephritis in cases presenting a history of scarlet fever exists about according to the law of averages.

Diphtheria Immunization with Diphtheria Toxoid (Anatoxin-Ramon). Max W. Bloomberg, Canad. M. A. J. **17**:801, 1927.

The authors report the results of injection of the diphtheria toxoid in the production of immunity in 572 cases. At first, two injections of 0.5 cc. at monthly intervals were given; later, 0.5 cc. at the first dose and 1.0 cc. at the second dose. Of the first group, 68 per cent were found immune at four months and of the second group, 84 per cent. Another group of thirty-two who gave positive reactions to the Schick test after two injections were given a third dose of 1.0 cc.; then 94 per cent gave negative reactions. One hundred per cent gave negative reactions after the fourth dose. Reactions were negligible.

Convalescent Serum Treatment in Whooping Cough. H. P. Wright, Canad. M. A. J. **17**:813, 1927.

Three children having pertussis were treated by injections of blood from children who had had pertussis. All showed definite improvement. The cases are reported in order to stimulate similar treatment by others, so that later more definite results may be reported.

An Epidemic of Roseola Infantum. H. B. Cushing, Canad. M. A. J. **17**:904, 1927.

The author reports six cases of roseola infantum in a ward of ten children. The relation of the cases to one another is so definite that Dr. Cushing concludes that the disease is mildly infectious.

Moore, Omaha.

Observations on the Dick Test. J. C. J. McEntee, Brit. J. Child. Dis. **24**: 91 (April-June) 1927.

From his observations, the author concludes that the Dick test is not reliable. He thinks that a polyvalent toxin would give a more reliable indication of susceptibility. "A Dick positive reaction indicates lack of circulatory antitoxin. It does not necessarily indicate susceptibility to scarlet fever; the patient may be negative to toxin of other strains causing scarlet fever, may be potentially immune, or may have a high degree of bacterial immunity in his throat." He concludes that: "Further investigation is imperative to determine

the varieties of toxic products of true scarlatinal streptococci, to solve the aberrant forms of scarlet fever, and to explain the apparent anomalous results of the Dick test."

LANGMANN, New York.

ORGANOVACCINE THERAPY IN THE ACUTE INFECTIONS. G. TACCONE, Riv. di clin. Pediat. **25**:348, 1927.

In a preliminary note, the author discusses organovaccines; they contain not only the pathogenic bacteria involved but also an extract of the tissue of an organ, preferably that one that is affected. The technic of preparation of a typhoid lymphovaccine is given in detail.

PROPOSED NEW METHOD IN THE MEDICAL TREATMENT OF PLEURAL EMPYEMA (PNEUMOCOCCIC) IN CHILDREN. CESARE COCCHI, Riv. di clin. pediat. **25**:410, 1927.

The author reports the cases of six children with pneumococcic empyema; they were treated by aspiration of pus, followed by injection into the pleural cavity of from 0.5 to 2.0 Gm. of sodium taurocholate (Merck or Kahlbaum) in varying concentrations. The clinical results were excellent; the author believes his method much safer than surgical procedure.

CLINICAL CONSIDERATIONS ON INTESTINAL AMEBIASIS IN CHILDREN. GAETANO ROSSI, Riv. di clin. pediat. **25**:433, 1927.

The author reports thirty-four cases of amebic dysentery in children. The younger the child the more severe was the infection. The lesions were usually limited to the large colon and rectum, the bladder occasionally being involved. Nonspecific treatment was usually unsuccessful. Emetine frequently gave brilliant cures but occasionally aggravated the symptoms. Arsenical preparations seemed more satisfactory; the author used stovarsol in many of his cases.

CRITICAL REVIEW OF THE PROBLEM OF THE PATHOGENESIS OF SCARLET FEVER, WITH PARTICULAR REFERENCE TO THE STUDIES OF DICK. S. BAUMATZ, Riv. di clin. pediat. **25**:505, 1927.

This is an eighteen page review of the recent literature on scarlet fever.

HIGGINS, Cincinnati.

EXPERIENCES WITH CYLOTROPIN IN CHILDHOOD. MARTHA PERL, Monatschr. f. Kinderh. **34**:1, 1926.

This combination contains apparently 40 per cent urotropin, 16 per cent sodium salicylate and 4 per cent caffeine sodium salicylate, and is used intravenously. The writer used this drug in infants and children in obstinate cases of pyelitis with good results. The dosage depended on the age of the child and varied from 2 cc. in infants to 3 or 4 cc. in older children. When intravenous therapy was technically impossible, injections were given intramuscularly in the thigh. This must be rather painful, for the author found it advisable to combine it with procaine hydrochloride.

GERSTLEY, Chicago.

TREATMENT OF OXYURIASIS. K. HAJOS, Orvosi hetil. **70**:299, 1926.

The author has seen good results from giving neoarsphenamine by mouth. The dosage ranges from 0.2 to 0.45 Gm. He combines this treatment with enemas and castor oil.

ZENTAY, St. Louis.

HYPERIMMUNITY WITH ANATOXIN. B. FEIERABEND, Prague, Čas. lék. česk. **64**:1172, 1925.

The author found that injections of anatoxin (toxin detoxicated without decrease of antigen bodies by solution of formaldehyde and exposure to heat) increased the antitoxin titer in the horse much more rapidly than did toxin antigen, for fifteen days or until the basal immunity was reached. After that, toxin produced a more rapid increase of antitoxin. He recommends the use of anatoxin for producing the preliminary immunity and then toxin for the hyperimmunity. In the case of diphtheria, this change can be made without decreasing the injected antigen units. In this new scheme, solution of formaldehyde replaces tricresol as an antiseptic, and titration of the toxicity of the toxin is obviated.

STULIK, Chicago.

INFLUENZA AMONG INFANTS AND CHILDREN IN KYOTO. Editorial in Bull. Oriental Child Health A., Child Series **1**:2 (March) 1927.

There were 646 cases of clinical influenza during the winter epidemic, with a mortality of 9 per cent. Two hundred and twenty-nine of these patients were under 1 year and 181 cases under 2 years. This makes 63 per cent of the total number up to 15 years of age and shows how prone the infants were to the disease.

SANFORD, Chicago.

Chronic Infections

THE PATHOGENIC ROLE OF TRICHOCEPHALUS DISPAR (TRICHURIS TRICHIURA). M. FERANA-NUNEZ, Arch. Int. Med. **40**:46 (July) 1927.

The author calls attention to the clinical importance of *Trichocephalus dispar* and reviews the facts obtained by various workers, in the hope that it may lead to further study of this important human parasite. He desires to direct attention to the possibility of *Trichocephalus dispar* as an etiologic cause in a great variety of conditions, and to disillusion those who accept it as a harmless parasite.

He gives in detail his method of study and makes the interesting and instructive observation: "Unlike *Oxyuris vermicularis*, the eggs of *Trichocephalus* do not hatch out in the intestine of its immediate host, but are eliminated with the feces. In the soil the eggs begin their development; the embryos form slowly in the periphery of the egg, and arrive at maturation in from six to ten months. Owing to the thick outer covering of the egg, the embryo can resist ice, intense heat, digestion or putrefaction. Davarine succeeded in preserving embryos of *Trichocephalus* in encysted form for more than five years. Ingested by a warm-blooded host they develop rapidly, provided they have remained in damp earth or water for at least a month before passing to the host. Before this interval the ova will pass through the intestinal tract without hatching."

The author quotes Howard as having "observed eggs of *Trichocephalus* in the feces of an infant age 14 days, and concluded that it was a case of intrauterine infection." He gives Pittaluga's classification for parasites in general for the pathologic effects produced on its host through various avenues. He states that in infections caused by *Trichocephalus*, the eosinophils show a constant increase that is greater than in infections due to other intestinal parasites, reaching from 30 to 40 per cent in some cases. To confirm this statement he

gives the observations made after the examination of blood of 512 patients who had helminth eggs in their feces. He further observes or believes from this study that the marked eosinophilia would seem to demonstrate that a few trichocephali are able to poison the patient in equal or greater degree than a large number of hookworms. In addition, he cites cases of appendicitis, with and without gangrene (one in a girl, aged 10), and cases of peritonitis, and calls attention to the relationship of trauma and necrosis of the intestine to the infection of parasites through traumatism of mucosa. He cites work done by others, notably by Weinberg and Guiart and Garin, on the high mortality of persons suffering from typhoid fever who were also infected with intestinal parasites; and of the parasites encountered, *Trichocephalus* was considered the most important.

Ferana-Nunez discusses experiments in intoxication and purpura hemorrhagica to show that *Trichocephalus* sucks the blood of its host and cites cases of septicemia, dysentery, toxic goiter, pernicious anemia, urticaria and acrocyanosis dystrophica, in which *Trichocephalus dispar* was the direct cause or contributory factor in these conditions.

The author believes that oil of chenopodium is the most satisfactory anthelmintic against *Trichocephalus;* as this parasite tends to lodge in the cecum and in the appendix, oral medication often fails, and he recommends injection of chenopodium intramuscularly or intravenously in persistent cases.

A brisk purge is always essential two or three hours after anthelmintic treatment, whether the remedy has been given by mouth or by injection.

He states that he has been apparently successful in vaccinating dogs against *Trichocephalus* infections by means of a vaccine containing eggs and larvae of *Trichocephalus* which had been carefully ground and inactivated. A report of this work was published in *The Journal of the American Medical Association* (**88**:903 [March 19] 1927).

LOEBER, New Orleans.

A CASE OF ACTINOMYCOSIS IN A CHILD EIGHT YEARS OLD. L. M. LINDSAY, Canad. M. A. J. **17**:994 (Aug.) 1927.

A case of actinomycosis in a child, aged 8, is reported. The condition was evidently of intestinal origin and spread either by continuity or by the portal circulation from the intestinal tract to the liver, and thence through the diaphragm to the right side of the thorax. Postmortem examination revealed the true nature of the condition.

MOORE, Omaha.

BRONCHIECTASIS IN CHILDHOOD. LEONARD FINDLAY and STANLEY GRAHAM, Arch. Dis. Childhood **2**:71 (April) 1927.

This article contains a partial review of the literature, omitting all American papers, and covers in detail twenty-three cases. Chronic pneumonia is usually accompanied by bronchiectasis. In many cases bronchiectasis may be present without any signs, or again, definite signs and symptoms may point to bronchiectasis when there is no dilatation. Iodized oil 40 per cent is essential in making a diagnosis. In twenty-three cases, ten of the patients were males and thirteen females; the age varied from 20 months to 13 years, the age at onset being from 4 months to 10 years. In all but three cases, the condition could be traced to some acute pulmonary disease. A cardinal symptom is chronicity without impairment of health. However, the children are under height and underweight for the age. Clubbing of the fingers was present in eleven cases; this had no relation to the duration but possibly influenced the extent of the disease.

Cough was present in all but one case and was usually accompanied by expectoration. Physical signs varied greatly. The roentgen rays revealed most diverse pictures and should not be depended on entirely except after the injection of iodized oil 40 per cent. In bronchiectasis, the iodized oil was limited to the lumina of the bronchi of the affected area as dense shadows; on healthy lung, it was widespread like a fine powdering. The oil disappeared from the affected areas in from seven to ten days, but in the normal area it persisted for from three to eight weeks. Bronchiectasis tends to be limited to one lung or one lobe, rather the base, and more often on the left. In children, a general anesthetic is advised and injection through the cricothyroid. The technic is described in detail. The condition shows no tendency to heal. Concerning the etiology, pulmonary fibrosis and pleural adhesions take the chief share.

PYELITIS IN INFANCY. BRUCE CHOWN, Arch. Dis. Childhood **2**:97 (April) 1927.

A thorough study of pyelitis in infants under 2 years is presented. The literature is more critically and accurately reviewed than has ever been done. The result is "we have complete information in only nine cases of pyelitis in infants under 2 years. In eight of these there was a suppurative nephritis with insignificant lesions elsewhere in the urinary tract, while in one case there was a cystitis alone. The only case on record of pyelitis verified by microscopic examination is that reported by Cabot and Crabtree, and this report is incomplete." The data presented are taken from the records at Johns Hopkins. The cases are divided into three groups:

I. Acute or subacute with (1) uniform manifestations of multiple, focal, interstitial and suppurative lesions in the kidneys; (2) only the slightest pathologic changes in the pelves, ureters or bladder; (3) recovery of *B. coli* when cultures were made; (4) association with infection elsewhere; (5) equal distribution between the sexes; (6) bilateral involvement with more severe lesions on the right.

II. Four cases in which a lesion was not found.

III. Chronic pyuria — the pelves did not show any source of pus, but the kidneys always were involved.

Cystoscopic descriptions of the lesions are conflicting and scanty or no mention of them is made, so that the evidence is of little value. It is difficult to understand how the current concept of pyelitis in infancy — as a primary inflammation of the renal pelvis — arose. It is erroneous, leading to error in diagnosis, treatment and investigation. The common lesion is a suppurative interstitial nephritis with secondary involvement of the parenchyma. The disease is not confined almost exclusively to girls. The route of infection is probably the blood stream. The etiologic factor is infection elsewhere. The term "pyelitis of infancy" is a misnomer. Pyelitis seldom, if ever, occurs as a sole lesion. The renal lesions are usually secondary to an inflammatory process elsewhere.

PETERMAN, Milwaukee.

A CASE OF CONGENITAL ABSENCE OF FEMUR AND A CASE OF EFFUSION INTO KNEE JOINT. C. MAX PAGE, Proc. Roy. Soc. Med. **20**:45 (July) 1927.

The first patient was shown chiefly in order to discuss treatment.

In case 2, the patient was a girl with the obvious appearance of a congenital syphilis. The Wassermann reaction was strongly positive. The author felt that the effusion into the left knee joint was a syphilitic manifestation and that it was not due to tuberculosis.

ERYTHEMA NODOSUM, LEADING TO THE DETECTION OF LATENT HILUS TUBERCULOSIS. F. PARKES WEBER, Proc. Roy. Soc. Med. (Clinical Section) **20**: 1049 (May) 1927.

The patient was a girl, aged 10, who was rather fat, with slight hypertrichosis of the back of the throat. The family history and her own past history were negative. The erythema nodosum was noticed on February 21. The patches were on the front of the legs over or close to the tibiae; she did not complain of pain. The cervical glands were enlarged, and the Pirquet cutireaction for tuberculosis was strongly positive, and a roentgenogram showed enlarged bronchial glands. In this case, the author believed that the attack of erythema nodosum should be interpreted as the manifestation of a mild bacillemia due to the escape of tubercle bacilli from some previously latent tuberculous focus probably in the lymphatic glands. Other infections as well as tuberculous bacillemia may give rise to an attack of erythema nodosum. It is therefore easy to understand why erythema nodosum may occasionally be followed by fatal tuberculous meningitis and generalized miliary tuberculosis.

WILLIAMSON, New Orleans.

THE DIFFERENTIAL DIAGNOSIS OF NONTUBERCULAR FIBROSIS OF THE LUNGS IN CHILDREN. C. D. AGASSIZ, Tubercle **8**:353 (May) 1927.

The differentiation of nontuberculous pulmonary fibrosis from pulmonary tuberculosis in children is often a difficult problem. A comparison of the salient features of each condition will emphasize the main points of distinction. The child with pulmonary fibrosis seldom gives a family history of tuberculous disease or of contact. The onset may frequently be traced to measles or whooping cough, followed by bronchopneumonia. A cough persists, which is worse in winter. Dyspnea may appear to be present, but the patients seldom complain of it. Cyanosis was a frequent occurrence, and clubbing of the fingers was present in two thirds of the author's cases. The heart is displaced toward the affected side, often in marked degree. There is diminished expansion of the lungs and diminished vocal fremitus. Percussion note is impaired, with dullness toward the base. Dry creaking râles and bronchial breathing may be heard. A characteristic feature of fibrosis is the alteration or aggravation of these adventitious sounds almost from day to day. Roentgen-ray examination shows the heart displaced and apparent bulging of the lung toward the affected side. Root shadows may be only slightly increased, with striations toward the base, or there may be dense massive shadows extending from the third to the sixth or seventh rib in front, radiating toward the base and blurring the cardiophrenic angle on one or both sides. The diaphragmatic outline is frequently irregular, in the form of undulations or peaks.

By way of contrast, children having pulmonary tuberculosis usually give a history of contact. It is seldom possible to trace the disease directly to measles, whooping cough or bronchopneumonia. Dyspnea may be complained of, with little evidence apparent to the observer. Cyanosis and clubbing seldom occur. Physical examination shows impaired resonance, most marked at the apex. Adventitious sounds are more in evidence in the upper portions of the lungs, and are more constant in character. Roentgen-ray examination during the active stage reveals a wooly mottling at the apex, extending downward, with darker shadows in cases that show fibrosis. The outline of the diaphragm is not often irregular.

The author is aware that the increased root shadows described as occurring in fibrosis are those which others hold to be one of the most constant signs of hilum tuberculosis. He is skeptical as to the frequent occurrence of the latter

condition, and is convinced that a careful consideration of history, cutaneous tests, symptoms and progress will bear out his contention that these are cases of nontuberculous pulmonary fibrosis rather than of hilum tuberculosis.

SMITH, Ogden, Utah.

CONGENITAL SYPHILIS AND THE ENDOCRINE GLANDS. RÔLE OF BIOLOGIC TESTS. L. SPILLMANN and J. L. CREHANGE, Bull. Soc. franç. de dermat. et syph. **34**:47, 1927.

In many cases of congenital syphilis, the authors used glandular therapy in conjunction with the usual antisyphilitic treatment. This procedure was placed on a firmer basis by the use of tests to determine the glandular condition.

THE NEUROTROPISM OF ACQUIRED SYPHILIS IN PATIENTS WITH CONGENITAL SYPHILIS. E. AUBRY and L. CORNIL, Bull. Soc. franç. de dermat. et syph. **34**:57, 1927.

The authors contend that general paralysis is frequently the result of acquired syphilitic infection in a patient with congenital syphilis of the first or second generation. They have seen cases presenting signs of congenital syphilis. They have observed general paralysis in parent and child, and even in three generations.

PARKHURST, Toledo.

TUBERCULOUS PERITONITIS AND ULTRAVIOLET RAYS. P. NOBECOURT and D. ILITCH DRAGOLIOUB, Paris méd. **26**:609 (June 25) 1927.

The authors treated a number of patients, using suitable controls, and conclude that ultraviolet light acts similarly to heliotherapy. Better results were obtained in the ascitic form than in the dry form of tuberculous peritonitis. They do not believe that ultraviolet light offers any advantage over sunlight, but that it is convenient to use in localities in which sunlight is not available.

SANFORD, Chicago.

THE INFLUENCE OF THE SUN'S RAYS ON THE SKIN; REACTION TO TUBERCULIN. MARCELLE TALON-CHAUVEAU, J. VALTIS and L. R. TALON, Presse méd. **61**:949 (July) 1927.

When tuberculin tests are carried out on those parts of the body that have been exposed to sunlight, the reaction is negative or weak, even when the reaction in other nonexposed parts is strongly positive. Accordingly, the test should be carried out on some part of the body that has not been exposed to sunlight.

FRAWLEY, Fresno, Calif.

ON THE BLOOD PICTURE IN THE TUBERCULOUS DISEASES OF CHILDHOOD. CAMILLO, CISI, Riv. di clin. pediat. **25**:289, 1927.

The author reports the examination of the blood in eighty-five children with tuberculosis of various types. A neutrophilic leukocytosis, with lymphopenia and eosinopenia, is a poor prognostic sign; an increase in eosinophils and a normal proportion of polymorphonuclear neutrophils and lymphocytes usually indicate that the patient's condition is improving.

The ratio of Arneth was determined in each case. This ratio is obtained by counting the number of segments in each neutrophil; the number of cells having one or two segments plus half the number having three segments, as contrasted to the number having more than three segments plus half the number having three segments give this ratio. Arneth and subsequent investigators had found that this ratio in normal adults is 61:39, whereas in children

it is 70:39; in tuberculous adults, a high ratio usually indicates a poor prognosis, while a normal or subnormal ratio indicates improvement of the patient.

In the cases of tuberculous meningitis Cici found that Arneth's ratio was normal in seventeen and high in four. In all other types of tuberculosis it was high in forty-four cases and normal in only seven cases. The prognostic and diagnostic significance of Arneth's ratio is not great in tuberculous children.

HIGGINS, Cincinnati.

OBSERVATIONS ON THE SPINAL FLUID IN CONGENITAL SYPHILIS. K. SAMSON, Monatschr. f. Kinderh. **36**:16, 1927.

In twenty-five cases of congenital syphilis, 28 per cent showed normal fluids, 8 per cent, a slight lymphocytosis, 12 per cent, a definite meningeal reaction and the remainder slight changes of one sort or another. Of individual reactions, 36 per cent did not show any increase in cells. The Wassermann reaction was rarely positive.

As a guide to treatment, the spinal fluid is of little value as changes occur and disappear utterly independent of therapy. On the other hand, as a guide to prognosis, an outspoken meningeal reaction suggests an unfavorable involvement of cerebral function.

GERSTLEY, Chicago.

TUBERCULIN DIAGNOSIS IN CHILDREN. FRANZ HAMBURGER, Wien. klin. Wchnschr. **40**:875 (July 7) 1927.

In place of the Pirquet test, Hamburger employs the percutaneous inunction test devised by Moro. After preliminary cleansing of the skin over the lower part of the sternum with ether, a quantity of concentrated old tuberculin (Höchst) about the size of a pin head is rubbed in. A positive reaction, at the end of twenty-four or forty-eight hours, appears in the form of small red nodules in the tested area. These vary considerably in size and color; they may even be pustular. He warns against mistaking for a positive reaction the occasional finding of mere redness of the skin pores without infiltration. He believes that a properly performed Moro test is as reliable as the Pirquet reaction and has the advantage over the latter of being easier to perform and painless.

If a child reacts negatively to two Moro tests, Hamburger resorts to the intracutaneous (Mantoux) test, using 0.01 mg. of old tuberculin, and, if necessary, 0.1 or 1 mg. It is safer to begin with the small doses in children having active pulmonary symptoms. The bouillon may cause redness and induration at the end of twenty-four hours, which may be mistaken for a positive test. Such a false reaction, however, will have decreased at the end of another day, while redness and infiltration due to an actual positive reaction will have increased.

The author emphasizes the generally recognized fact that a positive tuberculin test is clinically of value mainly in the first two years of life. A negative test at any age helps to rule out tuberculosis when an infection of unknown cause is suspected.

OLMSTEAD, Seattle.

PERIARTERIAL SYMPATHECTOMY IN TUBERCULOSIS OF THE BONES AND OF THE JOINTS. ZAHRADNICKY, Čas. lék. česk. **64**:1441 (Oct. 3) 1925.

Jenckel corroborates the favorable results of Gundermann in children having tuberculosis of the bone with sinuses. Immediately after operation the arteries decrease in caliber and the extremity feels cool. In several hours, there is a rapid elevation of as much as 1.5 degrees, with definite redness and an elevation of blood pressure. There is rapid cessation of pain and subsequent decrease in the circumference of the extremity. The advantage of this method,

over the Bier hyperemia, is the prolonged constant hyperemia, brought on by the vasomotor mechanism. The beneficial effect does not last over six or eight weeks or after reestablishment of the nerve fibers. The author feels that the operation should be reserved for severe infections with sinuses and destruction of the bone as a last resort. In closed cases, conservative management is recommended, because of the possibility of the formation of an abscess or an aggravation of the focus.

ROENTGENOTHERAPY OF TUBERCULOUS PERITONITIS. I. STRATIL, Čas. lék. česk. **64**:1444 and 1486 (Oct.) 1925.

The author gives a résumé of tuberculous peritonitis since the work of Bircher in 1889 and Porter in 1902. The idea is that the roentgen ray does not kill or weaken the tubercle bacillus, but increases the phagocytosis of the epithelial cells. This liberates tuberculin (endotoxin), increases the temperature of the body and produces antitoxin, and thus increases the resistance toward the infection. The smallest dose compatible with increased phagocytosis should be used. Perhaps colloidal chemistry or the ultramicroscope may explain the actual mechanism of the reaction. The roentgen ray is recommended in fibroplastic peritonitis without surgical intervention because of the friability of structures; in ascitic forms after paracentesis, because of the absorption of rays by the fluid; and in cases showing large caseating glands or organs, such as pyosalpinx after removal of the foci. Gauss reports 33 per cent permanent good results in cases in which internal medication had been administered, from 28 to 30 per cent in cases in which operation had been performed and 80 per cent in cases in which radiation had been used. Contraindications for irradiation are amyloid kidney and nephritis and associated tertiary pulmonary tuberculosis. The optimal doses are from 0.5 to 0.1 of the skin erythema dose, and some authors use even less with good results. The technic consisted of divided doses over large areas to larger doses over alternating small areas.

Of the author's eight patients with clinical tuberculous peritonitis, one died and seven were clinically cured.

STULIK, Chicago.

PREVALENCE OF CONGENITAL SYPHILIS IN KYOTO. I. IZUKA, Bull. Oriental Child Health A., Infant Series **1**:2 (Feb.) 1927.

During ten years, the total morbidity observed was 4.3 per cent. Of these patients, 88.3 per cent were under 6 months, and 11.7 per cent were over 6 months. By far the greatest mortality was in the artificially fed; 76.8 per cent of those affected showed symptoms before the first month. The cardinal symptoms fell in the following order: (1) positive Wassermann reaction, 94.9 per cent; (2) enlarged spleen, 85.2 per cent; (3) malnutrition, 62.4 per cent; (4) rhinitis, 47.0 per cent; (5) falling hair, 45.6 per cent; (6) psoriasis of palms and soles and lesions of the skin, 40.0 per cent; (7) hernia, 18.1 per cent and (8) changes in the bones, 16.4 per cent.

SANFORD, Chicago.

Internal Diseases

PAROXYSMAL CARDIAC PAIN, THE SYNDROME IN YOUNG ADULTS WITH RHEUMATIC VALVULAR HEART DISEASE. SIDNEY P. SCHWARTZ, Am. Heart J. **2**:497 (June) 1927.

Severe paroxysmal pain of the characteristic cardiac type is not common in young adults with chronic rheumatic cardiac valvular disease. Within the past few years, five young adults with an antecedent history of rheumatic fever have been admitted to the wards of the Montefiore Hospital. Their main presenting

complaints were severe recurrent attacks of paroxysmal cardiac pain. The attacks are characterized by recurrent seizures of paroxysmal pains in the chest; violent palpitations of the heart; severe headaches and various associated vasomotor phenomena; marked pulsations of the peripheral vessels; paroxysmal rises in blood pressure and increase in pulse rate and respirations. The attacks may make their appearance anywhere from six months to twelve years after the first manifestations of rheumatic fever. The heart invariably presents multiple involvement of the valves, and all cases show marked incompetence of the aortic valve. Signs of decompensation are usually absent. Attacks have not been noted during an active course of fever, and they have seldom been preceded, accompanied or followed by any rise in temperature. The administration of amyl nitrite caused all symptoms to disappear rapidly in two of the cases. Four of the five patients are living, several years after the "crucial period," free from all symptoms of pain. Such periods of recurrent precordial pain in young patients with chronic rheumatic cardiac valvular disease do not in themselves indicate a poor prognosis as to life.

MANNING, Santa Barbara, Calif.

REPORT OF A CASE OF OSTEOGENESIS IMPERFECTA IN TWINS. ROE WELZ and B. L. LIEBERMAN, Am. J. Obst. & Gynec. **14**:49, 1927.

This is an interesting report of osteogenesis imperfecta occurring in single ovum twins. The roentgenograms show the multiple old and recent fractures that are so characteristic of this disease.

Both babies were girls and were delivered in breech presentation. The first baby lived nine hours, the second fourteen hours. There was a fracture of nearly every bone in both upper and lower extremities in various stages of healing. There were also healed fractures of most of the ribs on both sides; the clavicles in baby no. 2 were intact; in no. 1 both were fractured. Baby no. 1 weighed 1,750 Gm.; no. 2, 1,900 Gm. The result of a blood calcium test on the mother revealed 8.9; that of the second infant, 10.1. The blood Wassermann reactions were negative. The ratio of the thymus to the body weight was 1:58—; the ratio of the thyroid was 1:360. In the first baby the thymus ratio to body weight was 1:157; the thyroid ratio, 1:380. The epiphyseal lines seemed to be normal, grossly and microscopically.

ALLEN, Chicago.

MALIGNANT HYPERNEPHROMA WITH ARTERIOSCLEROSIS IN CHILDREN. P. R. DIETERLE, J. Nerv. & Ment. Dis. **65**:42 (Jan.) 1927.

The author presents a case of a girl, aged 4 years and 3 months, with autopsy after a history of convulsions alternating with stupor, and preceded a month previously by unilateral convulsions. The blood pressure was from 145 to 160 systolic and from 90 to 100 diastolic. Roentgenograms and operation confirmed the presence of a large irremovable tumor mass, which was diagnosed malignant nephroma on the basis of the pathologic process. Autopsy showed edema of the lungs, slight lymphoid hyperplasia, small genitalia, a small thyroid and a brain larger than normal with areas of cortical softening. The basilar artery showed thrombus formation and thickening of the wall of the artery. The intima of the cerebral vessels showed thickening of patchy character, with heavy deposits of lipoids, and the arteries showed increase in thickness of all layers. The striking feature of the case was the coincidence of the tumor of chromaffin tissue with arteriosclerosis, arousing the theoretic discussion of the relation of the suprarenal cortex to vascular changes and development of the brain, and the analogy to Alzheimer's disease, in which arteriosclerotic processes are related to hypothyroid states.

HART, Greenwich, Conn.

DIABETES IN CHILDREN. A. A. LEVY, M. J. & Record **125**:820 (Jan. 15) 1927.

The author states in this article that diabetes in children is apt to be severe; that the life of the diabetic child, however, has been made three times as long with the use of insulin; that the treatment of children presents many more problems than the treatment of adults and that children are in many ways more difficult to handle because they are susceptible to acidosis and coma is rapidly precipitated. Also, he states that they are more highly susceptible to infections which aggravate the diabetic condition intensely. He then gives the treatment of an uncomplicated form of juvenile diabetes and the treatment in a case complicated with an attack of tonsillitis followed a few days later by an attack of pneumonia and the pathologic changes underlying this diabetic condition.

In closing his paper, the author points out that the trend of modern practice is decidedly toward preventive medicine and advocates periodic examinations of all children as to general health and particularly for any possible suggestion of diabetes.

WILLIAMSON, New Orleans.

THE EFFECT OF TONSILLECTOMY ON THE ACUTE ATTACK AND RECURRENCE OF RHEUMATIC FEVER. WILLIAM H. ROBEY and LOUIS M. FREEDMAN, M. Clin. N. Amer. **10**:1105 (March) 1927.

Complete tonsillectomy is the best preventive of rheumatic fever, and therefore of rheumatic heart disease. It is important, however, that enucleation be complete, since even insignificant tonsillar remains are often the cause of recurrences, and throw discredit on the operation as a preventive measure. The occurrence of rheumatic heart disease after removal of the tonsils does not constitute a valid argument against the operation, since the heart disease may not manifest itself until several years after the attack of tonsillitis or rheumatic fever. In order that effective preventive measures may be instituted before serious, though hidden, damage to the heart occurs, it is necessary that physicians recognize the vague and insidious signs of rheumatic infection as it manifests itself in children. Prompt and thorough removal of the tonsils at this stage, when indicated, will undoubtedly lessen the frequency of subsequent involvement of the heart. The operation may be performed even during the height of the febrile attack without danger to the patient.

HIGH GRADE HEART-BLOCK UNDER THE AGE OF THIRTY. HOWARD B. SPRAGUE and PAUL D. WHITE, M. Clin. N. Amer. **10**:1235 (March) 1927.

Eleven cases of heart block occurring under the age of 30 are reported; the block was complete in nine and of a high grade in two. At this age, it appears to result most commonly from acute general infection, rheumatism, congenital defects and trauma. Diphtheria is the acute infection most frequently responsible for auriculoventricular block, but persistence of the condition longer than a few days is rare, since it is usually quickly fatal. A recent study of 100 cases of diphtheria showed no persistent lesions of the heart. Heart block occasionally occurs as a result of influenza, pneumonia and typhoid fever. Disturbances of conduction may arise during the acute stage of rheumatic involvement of the heart, possibly due to the presence of local perivascular infiltration (Aschoff bodies) or edema. Persistent heart block may follow rheumatic infection in young subjects, but as a rule the condition is transient. Congenital abnormalities, especially septal defects, may involve the conduction system. Trauma to the precordium seemed to be the cause of complete heart block in two cases observed by the authors. Cases illustrating these etiologic groups are reported.

The prognosis of heart block does not appear to be so serious in the young as in older subjects. It is not usually a progressive affair and seems to be not incompatible with a reasonably symptomless life or even complete health.

GLUCOSE AND INSULIN IN THE TREATMENT OF RECURRENT VOMITING. LEWIS WEBB HILL, M. Clin. N. Amer. **10**:1329 (March) 1927.

The well ascertained facts concerning recurrent vomiting are about as follows:

It is more likely to occur in children with highly strung nervous systems.

The prominent exciting causes are: physical or mental overstimulation; the onset of acute infections (tonsillitis); physical abnormalities of the digestive tract and poor posture. Acetonenemia often precedes the vomiting. During an attack, the creatine in the urine is increased as well as unoxidized sulphur and uric acid. Blood sugar has been found low. In severe attacks, the carbon dioxide combining power of the blood may be low. Diet probably has little to do with the condition.

Between attacks, the child's mode of living should be directed so as to minimize the likelihood of nervous and physical exhaustion. On theoretic grounds, a diet low in fat and high in carbohydrate would seem desirable. Easily absorbable carbohydrates should be provided at the onset of any acute infection. Tonsils and adenoids should be removed if the child is subject to frequent infections of the upper respiratory tract. Structural abnormalities of the digestive tract and poor posture should receive appropriate treatment.

As soon as the child starts to vomit, empty the lower bowel by enema and give a teaspoonful of milk of magnesia every half-hour until six doses are given. Even if the child seems to vomit everything he takes, give a teaspoonful of ice-cold orange juice or pineapple juice, sweetened with cane sugar, every fifteen minutes. From the onset of the attack, give from 4 to 6 ounces (118 to 178 cc.) of 5 per cent dextrose per rectum every four hours. Sodium bromide and chloral hydrate may be given through the bowel if there is great restlessness.

If the child becomes much desiccated and severe acidosis develops, a 10 per cent solution of dextrose may be given intravenously together with one unit of insulin for each 3 Gm. of dextrose. About 300 cc. may be given to a child, aged 8 years. Hill reports a case in which the dextrose and insulin acted as an absolute specific, and an attack could be stopped at any time by their use. There was opportunity to try this treatment three times in this case, and not only did the boy never vomit after receiving the dextrose and insulin, but also his whole condition changed for the better at once.

SMITH, Ogden, Utah.

ESSENTIAL THROMBOCYTOPENIC PURPURA; ETIOLOGY, PATHOGENESIS, PATHOGNOMONIC SYMPTOMS, DIAGNOSIS AND OPERATIVE TREATMENT. HARRY KOSTER, M. J. & Record **125**:97 (Jan. 19) 1927.

What factors inhibit the production of thrombopenia? One must consider this topic from two angles: the source of supply of the platelets and interference with the destruction of the platelets. Frank, believing that thrombocytopenic purpura belongs to the aplastic anemias, and also that the spleen inhibits function of the bone marrow, advised splenectomy.

Kaznelson believed that the thrombocytopenia was due to an excessive thrombolytic function of the spleen, and for this reason he advised splenectomy. Benson shows that splenectomy was not only followed by a rise in the number

of platelets, but afforded a relative protection against the purpuragenic power of antiplatelet serum. These experiments are given in detail. Characteristic of the disease is a prolongation of the bleeding time. The clot during thrombocytopenic purpura is much less firm and fibrinous than when the person is normal; this is probably due to the diminished number of platelets. After the application of a tourniquet to the upper extremity, a shower of petechia appears distally to the tourniquet within five minutes. This affords another demonstration of the vulnerability of the capillaries. Coagulation time is normal. Most authorities on the disease advocate splenectomy as a life-saving measure. The slow progress to the understanding of the condition has been caused by failure to observe carefully and to record all the phenomena. Careful and complete clinical investigation of every case would quickly result in the acquisition of all the necessary data to place the diagnosis on a much more precise basis.

WILLIAMSON, New Orleans.

INFECTIONS OF ACCESSORY NASAL SINUSES AS THE CAUSE OF CHRONIC NONTUBERCULOUS BRONCHITIS. FRANK B. KISTNER, Northwest Med. **26**:203, 1927.

Standard textbooks do not stress any relation between infections of the upper respiratory tract and persistence of pulmonary disease, such as bronchiectasis and bronchitis. As abscess of the brain frequently follows bronchiectasis, it is not possible that the abscess may occur because of an unrecognized sinusitis? Many patients assumed to be tuberculous may have chronic bronchitis perpetuated by sinus infection. There may be an extension from the sinuses by direct inhalation or by lymphatic drainage to the bronchial nodes.

Of 196 cases of chronic nontuberculous bronchitis, 190 were shown to have definite disease of the sinus. Of these, 164 have had adequate treatment. In early cases, in which the pulmonary infection is not too deep seated, complete recovery may occur.

The author reports results brilliant in many cases and on the whole uniformly good. A number of patients have been cured by lavage, but the best results have followed radical surgical treatment.

ACRODYNIA: REPORT OF SIX CASES. GORDON CHOWN, Northwest Med. **26**:257, 1927.

Chown reviews the literature and discusses the symptomatology, pathologic changes and treatment of this interesting condition. He reports four cases in detail and two others by diagnosis. Two patients died of septicemia. One recovered in six weeks under ultraviolet therapy. The other three recovered in nine months. Chown agrees with Bilderback that treatment by current methods leaves much to be desired.

CLINICAL OBSERVATIONS ON LOCAL IMMUNIZATION. HAROLD L. AVERILL, Northwest Med. **26**:368, 1927.

Averill reports treatment of twelve cases of purulent infection such as sycosis vulgaris, recurrent furunculosis, acne vulgaris, conjunctivitis and chronic infection of the antrum with Besredka's filtrates. The organism is grown on Huntoon's hormone broth or glucose veal broth and the culture passed through a Berkefeld filter. The filtrate is applied topically to the infected tissues. Improvement was seen in some acute cases, but little lasting benefit. The results were disappointing and inconclusive.

SCOTT, Philadelphia.

ANTHOCYANINEMIA AND ANTHOCYANINURIA. H. O. RUH and J. A. GARVIN, Ohio State M. J. December, 1924.

After studying the pigmentation in the blood and urine following the ingestion of beets, the authors concluded that the variability in results need not be attributed to individual variations in regard to the absorption of pigment or to any individual idiosyncrasy of metabolism, but depends on the amount of anthrocyanin in the beets themselves. Fresh deep red beets contain considerably larger amounts of the pigment than old beets, which would account for the greater frequency of anthocyaninuria in the spring months.

LESLIE, Chicago.

CONTRIBUTION TO THE STUDY OF THE TEST OF ALDRICH AND MCCLURE IN PEDIATRICS. JAMIE DE CARDENAS Y PASTOR, Arch. de Med., Cirurg. y Especialidades, no. 312, 1927.

The author describes the test of Aldrich and McClure which consists of the intradermal injection of 0.2 cc. of 0.8 per cent sodium chloride solution and noting the disappearance time of the resulting blanched circumscribed elevation. The disappearance time is much shortened in impending edema and to a lesser extent in cardiopathies, anemia and postfebrile scarlatina without apparent edema. Labbé and his associates in France believe that if both arms are injected instead of one, as originally described, it permits a more accurate determination of the disappearance time. They insist that the elevation must be observed not only visually, but also by slight palpation. They use a solution as strong as 8.5 per cent. Other French writers prefer to use a hypertonic solution of sodium chloride from 4 to 8.15 per cent and even as high as 20 per cent. They find that this gives the same results as an isotonic solution. Glucose solution, Ringer's solution, normal plasma and plasma from patients with edema have been used, and, according to Labbe, the rapidity of absorption is independent of the type of liquid injected, but depends solely on the water-taking (hidrofilica) power of the organism.

Other observers found that the rate of absorption depends to some extent on the region of the body injected and also on posture. According to Chevallier, it is important not to make an injection in an extremely edematous member, because the pressure may force out the test solution.

The author employs a 0.91 per cent solution of sodium chloride in his work, because this is truly isotonic. He states, however, that the concentration of the solution is not important. The use of a tuberculin syringe for greater precision in the quantity injected is emphasized.

After reviewing the literature on the subject, the present author details the results of the test in five unclassified cases, with the disappearance time as follows: secondary anemia, one hour; kalaazar, forty minutes; rickets, measles convalescent, ten minutes; postscarlatinal abscess, thirty minutes and scrofula, fifteen minutes.

In four patients with glomerulonephritis or nephrosis, the absorption time varied from three to twenty minutes. In two patients with heart disease, one with mitral stenosis with perfect compensation showed a disappearance time of sixty-seven minutes, and the other with mitral decompensation and edema, five minutes.

In forty-three patients with digestive and nutritional disturbances, the disappearance time was uniformly rapid.

The author concludes that in normal subjects the swelling disappears in seventy minutes or more. In disease of the kidneys or in generalized edema, the

time of disappearance is short, increasing as the edema becomes less and even before, showing that the edema has begun to disappear before it is actually evident. On the contrary, in pre-edema cases, the disappearance is rapid, even before the signs of edema are noticed.

His observations do not support the statements of some French authors that in athrepsia the absorption time is increased.

In cases of summer diarrhea (intoxication, toxicosis, cholera infantum), the time of disappearance was most rapid when the condition of the child became grave, and when improvement began, the disappearance time lengthened. In acute gastro-enteritis (toxic dyspepsia), he has observed by the test that the disturbance of the water balance is much less intense.

The author believes that this intradermal saline reaction is useful in controlling the water equilibrium, so important in many different pathologic states in children.

DWYER, Kansas City.

ASTHMA IN CHILDHOOD. VIENNA EVENING SEMINAR, Ars. Medica **5**:171, 1927.

In addition to the use of atropine and epinephrine in the treatment of asthma in infancy and childhood, after-treatment with calcium lactate and ultraviolet rays is advised. A particularly severe form of asthma occurring in spasmophilic children is described. This is designated as bronchotetany. It is stated that with antispasmodic therapy, the prognosis is good, whereas epinephrine may cause death. Ten per cent magnesium sulphate in doses of 0.2 per kilogram of body weight given subcutaneously is advised for immediate relief.

LESLIE, Chicago.

ACUTE CHOLECYSTITIS IN A FIVE YEAR OLD BOY, OPERATION AND RECOVERY. HAMBURG STAMMLER, Monatschr. f. Kinderh. **35**:481, 1927.

A boy, aged 5, was taken sick suddenly with abdominal pain, loss of appetite and vomiting. When seen two days after the onset, he was acutely ill, with anxious facial expression, superficial breathing, a pulse rate of 100 and a dry, coated tongue. The abdomen was rigid, distended and particularly resistant in the right upper quadrant. Operation showed an acutely distended bluish-red gallbladder with evidences of inflammation in the adjacent peritoneum and a little purulent fluid in the abdomen. Gallstones were not demonstrable.

A lymph node lying close to the cystic duct was enlarged to the size of a cherry stone. This may have caused occlusion of the duct. The gallbladder was removed, and the child made an uneventful recovery. The content of the gallbladder was sterile.

A CASE OF HEPATIC INFANTILISM. OSCAR GOTTCHE, Monatschr. f. Kinderh. **35**:505, 1927.

The author reports the case of a boy, aged 7, whose development was that of a 4 year old child. The emaciation was in sharp contrast to the greatly enlarged abdomen. The abdominal cavity was almost entirely filled by a hard liver with a smooth surface. A complete physical examination, roentgenograms of the skeleton, blood slides, serologic tests and functional tests of the liver failed to reveal anything definite. The author is inclined to diagnose the condition as hepatic infantilism, a term used by Lereboullet in 1901. According

to this conception, the general nutrition of the child is affected by a liver insufficiency in the same way as we have infantilism from intestinal or cardiac causes.

CLINICAL EXPERIENCES AND STUDIES ON THE ACTION OF A GUANADINE DERIVATIVE IN THE TREATMENT OF DIABETES MELLITUS IN CHILDREN. R. FREISE and F. EINEKE, Monatschr. f. Kinderh. **35**:537, 1927.

Recently a guanadine derivative has been perfected which when fed by mouth seems to have something of the effect of insulin. This preparation is called synthalin. In six children the writers found the preparation absolutely valueless. It had no effect on sugar in the urine or in the blood. Unfavorable results could not be attributed to it, but those children who received it needed an increased amount of insulin at the conclusion of the experiment. The writers do not attribute this to the action of the drug, but simply to the fact that insulin had been omitted for a time.

A CONTRIBUTION TO CALCIUM METALBOLISM IN OSTEOGENESLS IMPERFECTA. MAGDALEN TAUBER, Monatschr. f. Kinderh. **36**:12, 1927.

Tauber reports two children in the same family suffering with osteogenesis imperfecta. Studies in calcium metabolism showed a definite deficit in calcium. For 0.393 Gm. of calcium taken in, there was an excretion of 0.495. During the period of deficit of calcium the child developed many fractures. The other child showed neither as marked a calcium deficiency nor the large number of fractures. Retention of calcium in the severe case was aided mainly by strontium chloride and thymus tablets, less by ultraviolet rays, meat and turnip juice. This medication, however, did not seem to cure the underlying disease.

GERSTLEY, Chicago.

PRELIMINARY REPORT ON THE TREATMENT OF CHEMICAL BURNS OF THE ESOPHAGUS. TREER, Proc. German Otolaryng. Soc., Ztschr. f. Hals.- Nasen- u. Ohrenh. **15**:461 (Nov.) 1926.

The mortality from burns caused by lye is great, and the author recommends the system of early treatment of Saelzer as modified by himself. The process is divided into two phases. The first includes inflammation, necrosis, separation of slough and epidermatization. At this time the infiltration narrows the lumen and makes the wall more fragile; the lumen is further narrowed by spasm, so that at this period use of the bougie is dangerous. In the second phase the inflammatory reaction subsides and connective tissue develops in the infiltration and contracts still further. The cases in which there is invasion of the mediastinum or pleura are not included in the classification. The first phase lasts from four to eight weeks. The author begins treatment as soon as the first pains subside, using a gum rubber stomach tube, which is passed and left in situ ten minutes daily, regardless of pain or fever. A table of sizes for age is given. As soon as contraction begins, sometimes within two or three weeks, cylindric bougies are substituted. The author claims that the soft rubber tube is safer; that it conveys information to the tactile sense better than the harder, heavier probes; that one can determine with certainty whether or not it reaches the stomach, and whether or not there is also pyloric stenosis, and that from the quantity of crusts in the stomach one learns the amount of destruction of tissue.

LEWY, Chicago.

Nervous Diseases

GLUCOSE IN THE TREATMENT OF EPIDEMIC ENCEPHALITIS. LELAND B. ALFORD, J. Missouri M. A. **24**:29, 1927.

After calling attention to the divers pictures presented by epidemic encephalitis and the results it produces, the author gives his results of glucose treatment in "twenty-five or so cases."

Intravenous injections of from 200 to 500 cc. of a 10 per cent solution of glucose were made at intervals of from one day to one week, and in addition glucose was given by mouth. Sometimes he also injected insulin. At times severe reactions occurred, but no permanently harmful effects were seen. The dose administered by mouth was 1.5 ounces (43.5 Gm.) twice a day, made palatable by the addition of lemon juice and was continued indefinitely.

The justification of the method, he believes, lies in a protection of the brain against certain toxins. He tried only glucose.

Alford believes that, in spite of the variable pictures in encephalitis, the effects of glucose therapy have been too definite to be mistaken. Not only has life been saved, but convalescence has been shortened. His experience is largely with adults, but in children his results have not been good. The improvement is slow, not becoming evident for a week or more. He believes the results are as good as those obtained with tryparsamide in syphilis of the nervous system.

SCHORER, Kansas City.

ETIOLOGY OF ENCEPHALITIS FOLLOWING VACCINATION AGAINST SMALLPOX. C. LEVADITI, S. NICOLAU and V. S. BAYARRI, Presse méd. **35**:161 (Feb. 5) 1927.

The authors state that over 100 cases of encephalomyelitis following vaccination have been reported from Europe within the last three years, the earliest observation of such a sequela having been made in 1912. The following hypothetic etiologies are discussed: (1) the vaccine virus might be exceptionally neurotropic and so itself effect an encephalomyelitic localization; (2) encephalomyelitis might have been incubating or latent, and have been excited by the vaccination; (3) a virus hitherto unknown might be responsible.

Referring to the first hypothesis, if inoculations made from an affected nervous system have produced vaccinia pustules, the latter may be ascribed to the probable presence of vaccine virus in the nervous system after ordinary vaccination, without that virus having been responsible for encephalomyelitis. Experiments by Levaditi and others show that "neurovaccine" (Levaditi and Nicolau: *Ann. Inst. Pasteur* **37**:2, 1923) inoculated cutaneously into monkeys appears in the neuraxis in small quantities eight or ten days afterward without causing encephalitic lesions capable of killing the animal.

Biologic examination of a specimen from one of those stocks, the use of which had been followed by encephalomyelitis in the child vaccinated, showed that the specimen was not more neutropic (in animals) than were specimens from other lots of vaccine that had been used without causing encephalomyelitis in man. Neurovaccine inoculated intracerebrally into apes produced an acute hemorrhagic and inflammatory meningitis, with a small abscess at the point of inoculation; but there was no extension of inflammatory reaction into the parenchyma or along the vessels of other segments of the central nervous system. The difference between this histologic picture and that of postvaccinal encephalomyelitis, seemed sufficiently marked to justify the authors' conclusion that the two conditions were different; vaccine, at least, was not itself the cause of the postvaccinal process, and some other virus must be responsible.

Finally, a stock of neurovaccine (cultivated for several years in the brain of a living rabbit and believed to be free from any accompanying viruses) has been used by Gaillardo and his associates in Spain for nearly two and a half million vaccinations, without a single postvaccinal encephalomyelitic sequela.

On the other hand, direct evidence for the second hypothesis, that the postvaccinal disease is a genuine epidemic encephalitis lighted up by the vaccination is found in the identity between the morbidity curves of the two encephalitides, and in an analogy with herpeto-encephalitis, to which the neuraxis is rendered more susceptible by previous vaccinia inoculation.

Evidence against the third hypothesis appears in the negative results of cutaneous inoculation of rabbits with neurovaccine and herpeto-encephalitic virus simultaneously. Herpetic encephalitis could not be produced, apparently because the vaccine virus destroyed the activity of the other at the point of inoculation. This conclusion seemed to leave the field clear for acceptance of the second hypothesis.

HUDDLESON, New York.

ASEPTIC PURULENT MENINGITIS WITH INTACT POLYMORPHONUCLEAR NEUTROPHILS IN THE CHILD. P. GAUTIER and MADAME CHAUSSE-KLINIK, Rev. franç. de pediat. **3**:78, 1927.

The authors review cases in which numerous cells have been found in sterile cerebrospinal fluid. They add two cases which they have observed and also a discussion of experimental work. Clinically, the children have shown headache, stiffness of the neck, a positive Kernig sign, exaggerated, abolished or normal reflexes and a varying amount of temperature. The spinal fluid at first shows a preponderance of polymorphonuclear cells, apparently uninjured, and later a lymphocytic increase without any organisms at any time. Similar changes have been observed following the injection of casein and cocaine. The cause of the condition is not understood, but it is suggested that there may be a toxin secreted in the cerebrospinal fluid that is positively chemotactic for leukocytes.

LESLIE, Chicago.

AMYOTONIA CONGENITA AND FETAL MUSCULAR DYSTROPHY. GENNARO FIORE, Riv. di clin. pediat. **25**:319, 1927.

The author reviews thirty-four cases from the literature described as Oppenheim's disease. Many of these were not Oppenheim's disease, he thinks, but fall into the group of progressive fetal muscular dystrophies.

In Oppenheim's disease, the anatomic basis of the symptoms are hypoplasia of the peripheral motor neurones or of the muscles or of both. In this disease, there is a progressive improvement.

The author suggests that amyotonia congenita and the muscular dystrophies, both fetal and postnatal, be grouped under the general title, "Myelomuscular Dysplasias of Childhood, Regressive and Progressive."

HIGGINS, Cincinnati.

CONTRIBUTION TO THE PSYCHOLOGY OF CHILDHOOD. JOHANN SUSMAN GALANT. Monatschr. f. Kinderh. **36**:42, 1927.

This is one of a series of articles appearing in various magazines by this author. He believes that the sexual education of the child is greatly neglected and is not well understood by the average physician. If adults themselves have such ridiculous ideas concerning the relations of the sexes, how can children be expected to have any sane notions? He then gives several illus-

trations of absurd customs among the Russian peasants. He has recently procured a German translation of Tolstoy's "Reminiscences of Early Childhood," which he advises any one interested in the subject to read. He believes that a study of this book will give a valuable clue to the sexual psychology of childhood.

GERSTLEY, Chicago.

PREVENTION AND TREATMENT OF NEUROSES IN CHILDHOOD. J. K. FRIEDJUNG, Wien. klin. Wchnschr. **40**:855 (June 30) 1927.

Friedjung maintains that the most important factor in the prevention of juvenile neuroses is education of the parents in mental hygiene. Companionship of parent and child in daily life and in sports should be encouraged. The kindergarten is also of great value. When a neurosis has developed the physician must study the environment carefully, since these disturbances usually occur when the child's surroundings are abnormal. Such is the case with the child of quarrelsome parents, the only child, the step child, the one brother in a family of sisters, or vice versa, and the child reared by doting grandparents or maiden aunts. A happy medium must be struck between displaying too much or too little affection toward a child. In aggrevated cases, when the conditions at home cannot be improved, transfer of the patient to other surroundings is advisable. Only a few of these children need the aid of a psychoanalyst. Alcohol and coffee should be forbidden and meat limited in amount. In these cases the author uses few drugs except bromides. He employs gentian for nervous anorexia and senna for neurotic obstipation.

OLMSTED, Seattle.

Diseases of the Eye

EYE SYMPTOMS IN TUBEROUS SCLEROSIS. NITSCH, Ztschr. f. Augenh. **62**:73, 1927.

The author reports the case of a boy, aged 11, who had shown signs of retarded mental development. On account of poor vision in the left eye, he was brought into the eye clinic. A striking picture of a large white growth over the optic nerve extending forward into the vitreous was seen. The right eye, in which the vision was apparently normal, showed a similar small nodule. Since the description of these nodules in cases of tuberous sclerosis by Van der Hoeve, such ophthalmoscopic manifestations have in several cases pointed to the correct diagnosis of a cerebral disease in which similar nodules involved different parts of the brain, producing a mental deficiency, epileptic attacks and death. Nodules are also found in the heart, kidneys, breasts and elsewhere. The disease shows a tendency to affect several members of a family. The author believes that the disease is more common than is usually supposed and that the diagnosis may often be made with the ophthalmoscope.

GIFFORD, Omaha, Neb.

CONGENITAL SYPHILIS AND INTERSTITIAL KERATITIS IN MOTHER AND DAUGHTER. R. BERGMEISTER, Ztschr. f. Augenh. **62**:100, 1927.

The author's family, consisting of a girl, aged 10, with bilateral interstitial keratitis and other signs of congenital syphilis, and her mother, who developed interstitial keratitis several years later, offer an apparently proof example of the inheritance of syphilis in the third generation. The mother showed other definite signs of congenital syphilis such as typical changes in the humerus and tibia, and her father had died of general paralysis. This family apparently

contradicts the opinion of Sidler Huguenin and Igersheimer who, after investigating a large number of syphilitic families, were unable to affirm the appearance of congenital syphilis in the third generation. In the pediatric literature up to this time, seven or eight cases of proved syphilis in three generations have been reported.

Diseases of the Ear, Nose and Throat

THE DEAFENED CHILD IN THE ELEMENTARY SCHOOLS: THE ECONOMIC AND EDUCATIONAL ASPECTS. HAROLD HAYS, M. J. & Record **125**:723 (June 1) 1927.

A deaf child, unaware that he does not hear well, often thinks he is actually stupid, with the result that he gets an inferiority complex. It is only after many years of endless strain on the nervous system that in some way it is found out that the hearing is defective.

The problem of the present day educator is to nip deafness in the bud so that the child may advance in his class like the normal child. Recent surveys of the hearing of school children in the United States indicate that more than three million have defects in hearing. Not only do deaf children cause a certain retardation of the whole class, but a wear and tear of the teacher herself. These children often become repeaters, and as repeaters they become an economic problem. In 1913 the author, then in the New York Eye and Ear Infirmary, became interested in the many problems of the deaf. Inquiry showed that most of their trouble came on in childhood, but was not recognized until adult life. Shortly after this he organized "The New York League of the Hard of Hearing." The problem met was this: The deafened child was not being properly treated medically or properly handled in the school. This problem in New York was really a national problem.

The situation divides itself into two parts: the medical problem and the educational problem, and the latter divides itself into two parts, the determination of the defect in hearing and the placement of the child. The medical problem is a question of preventing defects in hearing and in restoring lost hearing. The examination and the placement of these children are then dicussed in the paper. For the purpose of placement, the author divides the children into four groups: (1) the mildly deafened child; (2) the moderately deafened child; (3) the extremely deafened child, and (4) the hopelessly deafened child. The author then discusses each group in turn.

WILLIAMSON, New Orleans.

TWO CASES OF SPASMODIC STRICTURE OF ESOPHAGUS. R. C. JEWSBURY, Proc. Roy. Soc. **20**:42 (July) 1927.

Two cases were reported in patients, aged 5 and 11 years, respectively.

WILLIAMSON, New Orleans.

REGARDING INTUBATION AND EXTUBATION. BRUNO TRAMBUSTI, Riv. di clin. pediat. **25**:266, 1927.

To prevent the patient from biting off the thread attached to the intubation tube, the author has covered the thread with a coating of wax.

HIGGINS, Cincinnati.

SINUS THROMBOSIS. REPORT OF CASE. G. ALEXANDER, Wien. klin. Wchnschr. **40**:705 (June 2) 1927.

Alexander, at an operation on a child, aged 5, with mastoiditis following streptococcus otitis media, observed signs of inflammation in the region adjacent to the lateral sinus.

Subsequently, when the patient developed chills and a remittent fever, he suspected sinus thrombosis and performed a second operation nine days after the first. There was thrombosis of the jugular vein, bulb and the sigmoid and lateral sinuses. After removal of the clots from the vein and sinus—the peripheral end of the jugular vein was left to drain at the upper angle of the incision in the skin (jugular skin fistula). Recovery was uneventful, except for a metastatic abscess in one arm.

The author pleads for early operation in suspected cases of sinus thrombosis, even though the diagnosis is not entirely certain, since delay too often renders operative measures useless. He recommends that the necessary surgical work be performed at one sitting in order to avoid the added shock of multiple operations. He prefers to ligate the jugular vein before opening the lateral sinus.

OLMSTED, Seattle.

INJURIES OF THE HYPOPHARYNX AND UPPER ESOPHAGUS CAUSED BY FOREIGN BODIES. VON EICKEN, Proc. German Otolaryng. Soc., Ztschr. f. Hals-, Nasen- u. Ohrenh. **15**:387 (Nov.) 1926.

Ninety per cent of all foreign bodies that lodge in the esophagus remain at the level of the cricoid cartilage. Immediate perforation rarely takes place, but prolonged pressure leads to inflammatory reaction or decubitus. Serious consequences may occur when the surrounding soft parts have become inflamed and therefore much more vulnerable, before any attempt at extraction is made, especially when the foreign body has irregular, sharp angle, hooks or other irregularities; for example, splinters of bone or dental plates. Any trauma causing bleeding should be treated with silver nitrate, 10 per cent. Any patient with the slightest injury should be held under observation, and others should be instructed to report the least disturbance.

What should be the procedure if the wall is perforated? Heretofore, the rule has been to make a free external opening to the site of injury and tampon the surrounding tissue, but war experience has shown that many perforating injuries heal without surgical intervention. The author shows a series of roentgenograms of patient with undoubted perforation and emphysema treated successfully without surgical intervention. He concludes that esophagotomy is indicated only when there is high fever, definite constitutional disturbance and severe pain, but when these symptoms are present it should be done as soon as possible.

LEWY, Chicago.

Diseases of the Skin

PITYRIASIS ROSEA OF THE SCALP: AN ALMOST INVARIABLE LOCALIZATION OF THE DISEASE IN CHILDREN. H. HAXTHAUSEN, Brit. J. Dermat. **39**:141 (April) 1927.

The author discusses the frequency with which pityriasis rosea in children is associated with involvement of the scalp. Of seventy-two cases of this disease examined during the past year, twelve were in children under 15 years of age; in eleven of these a distinct eruption of the scalp was present, while not a single eruption of the scalp was noted in an adult. The differentiation from pityriasis simplex and ringworm is mentioned. He concludes that pityriasis rosea on the scalp is not an exceptional occurrence, as far as children are concerned; and that if one holds the conception of pityriasis as

an infective disease, it leads to the supposition that in childhood the scalp is lacking in certain protective qualities, which are not acquired until the age of puberty. This fact already pointed out by Kumer would show a striking analogy to the conditions in ringworm, and the author feels that his observations, in a certain measure, tend to support the theory according to which pityriasis rosea is due to a species of fungus as yet unknown.

WIEN, Chicago.

APPEARANCE OF PLAQUES OF LEUKODERMA FOLLOWING AN ERYTHEMA DUE TO ULTRAVIOLET RAYS (ARTIFICIAL SUNBURN). E. JUSTER, Bull. Soc. franç. de dermat. et syph. **34**:111, 1927.

The leukoderma appeared four or five days after the erythema on the legs of a man, aged 60.

PARKHURST, Toledo.

SYMMETRICAL GANGRENE IN THE SKIN OF CHILDREN. BRUNO TRAMBUSTI, Riv. di clin. pediat. **25**:390, 1927.

A report is given of a child, aged 15 months, who developed symmetrical areas of redness on each buttock and calf. These areas became gangrenous and sloughed off; healing was slow and by granulation. The condition was not due to Raynaud's disease or to the more common causes (such as syphilis). The author suggests that a toxin of infectious origin acted to cause the localized trophic disturbances.

HIGGINS, Cincinnati.

Surgery and Orthopedics

TUBERCULOSIS OF THE SACROILIAC JOINT. C. J. MCCULLOUGH, Am. J. Roentgenol. **15**:150 (Feb.) 1926.

According to Ridlon, sacro-iliac tuberculosis occurs probably not as often as one case to a hundred of tuberculous hip. It is found in young adults and rarely in children. Pain, limitation of motion, peculiar attitudes in sitting, standing or walking, swelling and feeling of weakness or insecurity of the back are the usual symptoms. Differential diagnosis includes iliosacral arthritis, relaxation, strain or subluxation, malignant disease and related condition, such as tuberculous hip, tuberculous spine, sciatica, infections and malignant disease of adjacent bones, traumatic sprain of lower back not involving the sacroiliac joint, arthritis of the spine, disease or displacement of pelvic organs and defective posture, producing backache. The treatment consists of immobilization, with a plaster cast of the body and especially of the well leg, to prevent the strain of activity.

STULIK, Chicago.

1. THE USE OF PEDICLED SKIN FLAPS IN THE TREATMENT OF SYNDACTYLY. 2. TERATOMA OF MESENTERY. 3. TWO CASES ILLUSTRATING USE OF PEDICLE FLAPS. C. JENNINGS MARSHALL, Proc. Roy. Soc. Med. **20**:47 (July) 1927.

The teratoma of mesentery was reported in a girl, aged 8.

The author used pedicle flaps in a case of large cavernous angioma of the heel and also in the case of a large, hairy and papillomatous mole on the right side of the forehead, the root of the nose and the malar and temporal regions.

WILLIAMSON, New Orleans.

Is It Always Necessary to Intervene in Umbilical Hernia of the Embryonal Period? Ugo Trinci, Riv. di clin. pediat. **25**:338, 1927.

The author reports three cases in which the treatment was not surgical and which terminated satisfactorily. The tumors in these cases were approximately 6 by 5 cm. at the base. The surgical risk in this type of case is high, 70 per cent ending fatally.

Higgins, Cincinnati.

Miscellaneous

Actinotherapy in Pediatrics. J. H. Gettinger, Arch. Pediat. **43**:251, 1926.

The field of inquiry into the exact manner ultraviolet rays exert their beneficial effect is by no means exhausted, and while it is known that these rays are absorbed by the blood, we do not know how they are stored or in what manner or form they are set free in the tissues. In this respect the ultraviolet rays resemble very closely the vitamins whose specific actions are not known, but whose metabolic influences have been proved. Of course, it is too early yet to accept actinotherapy with unrestrained enthusiasm, for its performance is mostly in the throes of empiricism. With the accumulation of favorable clinical evidence, it becomes incumbent on us not to gage our dicta only in accordance with the concepts of arbitrary scientific formulas, since most of our therapeutic triumphs are the crystallized products of our empirical procedure, but we must at present practice actinotherapy as a therapeutic art, until clinical evaluation will ripen it to a well defined scientific medium.

Properties of Some Fabrics Used for Infants' Underwear. Harold K. Faber and Fannie Hadden, Arch. Pediat. **43**:283, 1926.

The chief practical desiderata of infant's underclothing are: 1. Reasonably slow conduction of heat. 2. Ability to absorb body moisture in reasonable amounts, depending on wetting properties and capacity for holding water. 3. Porosity, to permit passage of air to and from the skin. 4. Ability to withstand efficient cleansing and preferably boiling, without rapid deterioration. 5. Smoothness of texture and surface, to prevent irritation of the skin.

As far as diapers are concerned, it was shown that birdseye material is the best suited for the purpose of all the materials that are used in making diapers.

Von Meysenbug, New Orleans.

Transfusion of Incompatible Blood. P. Morville, Bruxelles-méd. **6**:1562, 1926.

An account of loss of blood from uterine rupture two transfusions of 300 and 500 Gm. were given from different donors with compatible blood according to direct tests. Four days later, after pain in chest and some disturbance of respiration, jaundice developed. Further tests now showed that the patient and the donors belonged to different blood groups. After death thrombosis in pulmonary vessels was found. Morville recommends that in direct tests two drops of the recipient's serum be added to six drops of sodium chloride solution to obviate pseudo-agglutination.

[Arch. Path.]

Primary Specific Allergy and Idiosyncratic Shock. Von Starck, Monatschr. f. Kinderh. **32**:119, 1926.

The author describes the very interesting case of a breast-fed child, aged 5 months, who had an idiosyncrasy to green peas. The baby was brought to the clinic for an obstinate skin eruption, dry in type, covering the face, buttocks,

hands, and popliteal space. The examination showed a healthy child, weighing 12,900 Gm., with no abnormal conditions other than a slight cervical adenopathy. The spleen was not palpable. The urine was normal. The hemoglobin was 85 per cent; polymorphonuclears, 56 per cent; lymphocytes, 39 per cent; mononuclears, 3 per cent; and eosinophils, 4 per cent.

In attempting to find out the relation between the eczema and the food, the author, by taking a careful history, learned that the mother had at times attempted to give the child some puree of peas. Each time she did this there appeared edema of the face and an increased itching of the skin.

The child was taken into the clinic and an effort was made to relate the green peas to the skin eruption by feeding a little of the puree.

The baby took the first three teaspoons well. Then, in an instant, swelling and blue discoloration of the face was followed by cessation of respiration and collapse. In spite of immediate treatment with stimulants, oxygen and artificial respiration, the child died in a few minutes. Necropsy was not permitted.

The remainder of the article is devoted to a theoretical discussion and a review of the literature, relating these cases of idiosyncrasy to food to the general subject of anaphylaxis.

GERSTLEY, Chicago.

THE IMPORTANCE OF DISPOSITION IN THE ORIGIN AND COURSE OF EPIDEMICS. R. FREUND, Ztschr. f. Hyg. u. Infektionskrankh. **106**:627, 1927.

During the spring of 1925, Freund made a careful study of an epidemic among rabbits and guinea-pigs in the animal quarters of the "Institut Robert Koch." He discovered as causative agents in all affected rabbits and in some of the guinea-pigs bacilli belonging to the group of hemorrhagic septicemias, while in other guinea-pigs the infection was caused by pneumococci or in a few cases by *Bacillus paratyphosus* B. At first glance, it appeared as if the development and course of the epidemic was due to the dissemination of the infectious bacteria and their effect on the animals, but a more careful investigation revealed that the infectious agents were incapable of producing a true infection in healthy animals, both experimentally by introduction by way of the skin, the lungs, the conjunctiva or the intestinal canal, and naturally by a close association of sick and healthy animals. It was evident that the epidemic-like infections were caused by conditions which temporarily had lowered the resistance of the animals to infection with these bacteria. The presence of such influences could be demonstrated. They consisted in exposure to low temperatures during these months. It could be shown experimentally how dangerous even a transitory injury to the mucous membranes is in the animals. By instilling a 1 per cent solution of nitrate of silver or of mustard oil into the conjunctiva or the nose disease was produced in seven of eight rabbits which corresponded to spontaneous rabbit septicemia. The animals developed coryza and septicemia. The animal body evidently possesses strong protective mechanisms in the mucous membranes and lymph nodes at the natural points of entrance of bacteria. The micro-organisms can gain a foothold and later cause general infection only when these are weakened in some way or other. The type of infection produced in this way depends on the virulence of the bacteria which happen to be present on the mucous membranes. If virulent bacilli of the hemorrhagic septicemia group are associated with pneumococci of low virulence the former will cause the infection. If the virulence of the different bacteria is more equally balanced, mixed infections arise in which two or more bacteria participate.

OPHÜLS, San Francisco.

A Simple Method for Reduction of Heat in the Local Finsen Treatment and Increase of Light Exposure. Svend Lomholt, Ugesk. f. Læger. **22**:541, 1926.

A water filter from 31 to 91 cm. absorbs almost all of the ultrared rays, and decreases the heat from light 30 to 40 per cent. It is these rays that are absorbed in the superficial layers of the skin and are the chief cause of burns and pain. The absorption of these rays by the water filter makes it possible to increase the intensity of exposure at least 60 per cent and the beneficial effect exerted on lesions is even greater.

Schlutz, Minneapolis.

Society Transactions

CANADIAN SOCIETY FOR THE STUDY OF DISEASES OF CHILDREN

Fifth Annual Meeting, June 13, 1927, Toronto, Ontario

ENLARGED THYMUS. Some Observations on the Physiology and Anatomy of the Thymus and Thyroid Glands. Presented by DR. HOWARD SPOHN.

This paper is a continuation of the report of work started four years ago in Vancouver by Dr. Howard Spohn in association with Dr. H. A. Rawlings, a roentgenologist.

The frequency of occurrence of enlarged thymus is discussed and the opinion advanced that there are thymic belts and that these belts correspond to regions in which pathologic conditions of the thyroid are found. In support of this theory, some statistics of comparison between different regions in America are given and note made of the apparent rarity of occurrence in different European localities. Professor Feer of Zurich, however, has found the condition fairly frequently in the locality in Switzerland in which he lives.

The observations of Professor Warthin of Ann Arbor and Sir James Berry of London are quoted in regard to the occurrence of enlarged thymus in relation to toxic goiter. Sir James Berry has made a careful survey (extending over thirty years) of the clinical histories and pathologic specimens of all the cases of thyroid disease in all the museums in London. He has made the observation that every patient who died of toxic goiter showed, on postmortem examination, an enlarged thymus gland. The conclusions of Sir James Berry and Dr. Scott Williamson in regard to the physiology and anatomy of the thymus and thyroid are extensively quoted.

After a study of 120 cases of enlarged thymus with symptoms, in which treatment was done, the author is strongly of the opinion that in the majority of cases an internal secretion rather than pressure from enlargement is responsible for symptoms.

Clinical reports and roentgenograms of patients treated were shown, and attention was drawn to those showing a large thymus and not any clinical symptoms.

SEROUS MENINGITIS. Presented by DR. GEORGE F. BOYER.

This paper is given over to a short discussion of the conditions that enter into the clinical diagnosis of serous meningitis. There is no unanimity in the nomenclature, and there are some who doubt that the cerebrospinal fluid is sterile, but it must be admitted that the fluid is different in its cultural characteristics from that found in the pyogenic meningeal infections. There is some discussion of the origin of the fluid, the origin of the cells of the cerebrospinal fluid and the absorption of the fluid, and it is pointed out that because of the different characteristics of the cerebrospinal fluid from different loci of the system that the cellular reactions of serous meningitis may vary greatly. The diagnosis depends on clinical examination as well as examination of the cerebrospinal fluid. A typical case is cited, and a series of twenty-four cases is briefly reviewed.

A CASE OF MONGOLIAN IDIOCY OCCURRING IN ONE OF MALE TWINS. Presented by DR. GORDON CHOWN.

Twenty-five cases of mongolism occurring in twins have been reported in the literature. An additional case is reported.

The twins were aged 13 months. The father was 34 and the mother 31. There had not been any miscarriages, or any history of syphilis, tuberculosis

or alcoholism. This was the first pregnancy. The twins were born at full term. The weight at birth was unknown. The mother stated definitely that the mongolian idiot was born two days later than the normal twin, and that forceps were necessary to effect delivery.

This fact supports views of McLean, Halbertsma, Strauch, Mitchell and Downing that when mongolism occurs in twins it is a result of a double ovum pregnancy and that the etiology is due to a defective germ plasm.

CARDIOSPASM. Presented by T. CROSSAN CLARK.

Cardiospasm has been known as a clinical entity for more than a century. Purton, in 1821, reported the first case. In 1878, Zenker and Vonziemssen compiled reports of seventeen cases from the literature. Recently the subject has been elaborated by Einhorn, Sippy, Smithies, Plummor, Vinson and others. Most observers agree that at postmortem the cardia appears quite normal and that there is a hypertrophy and dilatation of the esophagus, with a chronic esophagitis. Despite the large number of cases of this condition that have been reported, the cause is still undetermined although numerous theories have been advanced. The onset is sudden in 17 per cent (Mayo's) of the cases and gradual in 83 per cent (Mayo's). The predominant symptoms are dysphagia, pain and regurgitation.

Dysphagia frequently occurs suddenly while the patient is eating solid food, especially an apple, or while drinking cold water. An interesting feature of this symptom is that although the patient may be able to wash solid food into the stomach by drinking large quantities of water, he is not able to drink cold water alone.

There is a great variation in the degree of pain in cardiospasm.

Regurgitation occurs with the onset of dysphagia. F. S., a girl, aged 5 years, vomited every meal every day for six months. Treatment consisted of a series of ten dilatations, over a period of two and a half months, using bougies from no. 21 to no. 36. Since the first dilatation, the child has not vomited, has been able to eat all kinds of solid food, has shown steady gain in weight from 34¼ to 37 pounds (15.7 to 16.8 Kg.) and has become sturdy and strong.

PEMPHIGUS IN THIRTEEN YEAR OLD CHILD. Presented by DR. E. A. MORGAN.

The attack was ushered in abruptly with a fairly high temperature. The lesions were confined to the mucous membranes — oral, nasal, conjunctival and vaginal. Loss of weight was severe and rapid. Recovery commenced at the end of the first week and was complete in three weeks. There has been no sign of recurrence for eight months. It is probable that the prognosis in this condition is more favorable in children than in adults.

COURSE AND PROGNOSIS OF DIABETES IN CHILDREN. Presented by DR. GLADYS BOYD.

Ninety-five cases of diabetes mellitus in children under 15, treated at the Hospital for Sick Children, Toronto, were studied to determine the outlook of the diabetic child as to health and any possible recovery. Most of the children of the group had several forms of diabetes. The following observations were made: Normal growth and development occur in the diabetic child treated with insulin. Expectation of life in these cases has already been doubled. Diabetes in children is a rapidly progressive disease which may, however, be arrested in its course and even made less severe by proper treatment. Functional improvement is made only under adequate control of the blood sugar and may readily be lost if the control is not maintained. Pathologic study offers certain evidence favorable to the belief that pancreatic regeneration may occur. The most important factor in the prognosis of a diabetic child is the degree of cooperation obtainable from parents and child in maintaining adequate control of the disease.

THE MATURING CHILD. Presented by DR. ALAN CANFIELD.

THE STORY OF CIRCUMCISION. Presented by DR. GEORGE PIRIE.

THE USE OF PARA-THOR-MONE IN THE TREATMENT OF INFANTILE TETANY. Presented by DR. D. B. LEITCH.

In eight clinical cases of tetany the patients were treated with 2 cc. of parathyroid extract-Collip given subcutaneously each day until there was marked improvement. The clinical symptoms were tabulated along with the calcium content of the blood serum, which was estimated on alternating days. In seven of the cases no medication was given except parathyroid extract, and in these cases four injections were required to bring about amelioration of the symptoms. It was found that the clinical symptoms of tetany would disappear before the serum calcium would return to normal levels. The eighth patient had an extremely severe case; he required 10 injections of 1 cc. each of parathyroid extract-Collip. Because of his severe symptoms, he was also given 15 grains (1 Gm.) of calcium chloride daily. The results to date seem to indicate that in the ordinary mild cases of tetany 2 cc. of parathyroid extract-Collip a day for four days will eradicate all clinical symptoms.

THE ANTIRACHITIC EFFECT OF SUNLIGHT. SEASONAL VARIATION. Presented by DR. ALAN BROWN and DR. F. F. TISDALE.

AN EARLY CASE OF CONGENITAL PYLORIC STENOSIS. Presented by DR. L. P. MACHAFFIE.

The interesting features of the case were the early onset of symptoms, the nature of these symptoms and the successful performance of the radical operation, thirty-four hours after birth, followed by a complete recovery.

The symptoms that appeared a few minutes after birth were swallowing, gagging, cyanosis of the face and extremities, puckering up of the mouth and spitting of a frothy, clear fluid. The infant cried lustily and the color was good between the attacks, which occurred every five or six minutes. A catheter was readily passed into the stomach. Projectile vomiting occurred as soon as fluids were given. A barium meal showed complete obstruction at the pyloric end of the stomach; 1 ounce of fluid was passed in and the stomach had the appearance of a small lemon, the nipple-like projection on the lemon corresponding to the pyloric end. The meal was retained for three or four minutes, but the infant squirmed and wiggled and was apparently in great distress; finally the whole meal was ejected in a projectile fashion. No tumor could be palpated, and visible peristalsis was not detected. Without preliminary preparation such as transfusion or hyperdermoclisis, the infant was successfully operated on (Rammstedt operation) under a general anesthetic (ether). The surgeon described a firm, gristle-like tumor, the size of a shelled peanut, at the pylorus and gas could not be forced from the stomach into the duodenum. The infant came out of the operation in good condition and made an uninterrupted recovery, although vomiting during the early months following the operation was a frequent occurrence but was not of a projectile nature.

Another interesting feature was the fact that for the first six days the bowels moved frequently and that during the first twenty-four hours, every time the infant would gag and spit there would be a movement of the bowels.

The gagging and cyanosis disappeared after the first twenty-four hours, but projectile vomiting definitely established itself.

A CASE OF ACTINOMYCOSIS IN A GIRL OF EIGHT YEARS. Presented by DR. L. M. LINDSAY.

The child had been ailing since an attack of pneumonia nine months previously. She complained of cough with pain in her right side and, occasionally, loose stools. She was pale and thin. Physical signs and the roentgen ray suggested an empyema of the right side of the chest. The spleen was easily palpable. The leukocytes numbered 18,000; the urine contained albumin, pus and casts.

Thoracic puncture was negative. Laparotomy revealed an enlarged liver, with nodular masses on the surface suggesting a sarcoma. She died four months later, after an irregular febrile course with distention of the abdomen and ascites. At autopsy, the abdominal cavity was found full of clear yellow fluid. The viscera were walled together with adhesions; multiple abscesses exuding greenish yellow pus were found in the liver and right kidney, and ulcerations occurred in the rectum. The right thoracic cavity contained free fluid, and the collapsed lung was bound down by dense adhesions. The lung cut like liver, and the gaping bronchi exuded greenish pus. The ray fungus was found in the pus.

FURTHER OBSERVATIONS ON ASTHMA AND ECZEMA WITH SPECIAL REFERENCE TO TREATMENT. Presented by DR. GEORGE A. CAMPBELL.

The allergic diathesis as manifested by asthma, eczema, recurrent vomiting and urticaria is hereditary in origin and is aggravated by prematurity, but is still of unknown etiology.

Eczema in breast-fed infants can be promptly cured by removing from the mother's diet the food to which the infant reacts. If this includes milk, the breast milk will soon prove insufficient. A mixture of cream or butter and a suitable cereal diluent to which powdered milk is cautiously added forms a satisfactory substitute.

Itching of the face may be successfully treated by complete and continuous protection by a mask, while the patient is in the hospital, using butesin picrate ointment under the mask. A 3 per cent borax solution is a suitable cleansing agent.

Eczema cured by the removal of milk, wheat and egg from the diet and silk, wool, orris root and timber wolf from the environment of the patient is reported.

Deaths occurring immediately after weaning that apparently are due to food hypersensitiveness are described. These infants die in a state of acidosis. The sudden weaning of eczematous infants may be dangerous. Desensitization with minute doses of offending foodstuffs by mouth should be started early in such cases.

A negative phase may follow the acute attack of asthma, during which skin tests are negative.

Children suffering from typical asthma will always give positive reactions to some protein if sufficiently complete tests are made.

Horse dander is the most important and frequent cause of asthma. These children have their worst attacks in the spring and fall. They must be desensitized.

Keratin is a frequent cause of asthma. It is contained in glue, gelatin, skin, hair, nails and the connective tissue of meat and fish. Reactions may be obtained with glue protein. Egg and milk sometimes cause asthma and recurrent vomiting. Egg is used in so many foods unsuspected of containing it, such as macaroni and biscuits, that in cases refractory to egg the patients should be desensitized.

Mustard in the form of poultices and flaxseed in patent cough cures will aggravate asthma in susceptible children.

Cases of asthma due to radish, cheese, milk, canary feathers, various furs and hog hair (in mattresses) are reported.

No striking change is noted in the sensitivity of asthmatic children retested year after year.

Ephedrine, if given in sufficient dosage to control attacks, is apt to induce a state of collapse.

Urticarial and epileptic children do not usually give reactions to foreign proteins.

THE CHOLESTEROL CONTENT OF THE BLOOD OF INFANTS AND OF YOUNG CHILDREN. Presented by DR. ALTON GOLDBLOOM and DR. RUDOLF GOTTLIEB (by invitation).

Goldbloom and Gottlieb studied the cholesterol content of whole blood in normal children of various ages and in children suffering from various diseases.

They found that the cholesterol of whole blood varied with age in normal children, the highest values being obtained from blood from the cord. They found this increase to be due principally to the greater number of red and white blood cells in the blood of the new-born. Samples of plasma from blood from the cord showed the same low values already reported by others.

The relationship of cholesterol content of whole blood to age seems to be maintained even in cases in which cholesterol seems to be increased, as in typhoid or eczema. The highest values were found in typhoid fever, and there were marked increases in streptococcic infections, such as chorea, scarlet fever and rheumatic carditis. One child with acute suppurative streptococcus arthritis of the knee showed no increase. Cretinism showed considerable increases when thyroid was not given, with a fall to normal during the administration of thyroid extract, but not, however, when insufficient thyroid extract was administered. No increases were found in acute bronchopneumonia. The lowest values were found in children suffering from chronic tuberculosis of the bone, celiac disease and amyloid disease.

No cases of nephrosis or diabetes in children were studied in this series.

AN EPIDEMIC OF ROSEOLA INFANTUM. Presented by DR. H. B. CUSHING.

A report is given of six cases of roseola infantum occurring in one ward of an infants' hospital. The first patient developed the disease six days after admission to the ward, and the others at intervals of from ten days to two weeks after exposure to the disease. From this it is argued that roseola infantum is a definite contagious disease with an incubation period of from ten days to two weeks. Since only children between the ages of 4 months and 2 years are apt to develop the disease in its characteristic form, two cases are not apt to occur in one family; hence its contagious character has not been previously demonstrated.

SOME DIFFERENCES IN THE BEHAVIOR OF RAW, PASTEURIZED, BOILED, EVAPORATED AND DRIED MILK AT THE HYDROGEN ION CONCENTRATION OF THE STOMACH. Presented by ANGELIA M. COURTNEY.

A comparative study was made of the behavior of evaporated, dried, heated and unheated fresh milk at hydrogen ion concentrations typical of the contents of infants' stomachs, according to Marriott's experiments; that is, at p_H 3.75, 4.75 and 5.35, respectively. The acidities were obtained by adding uniform quantities of fifth normal hydrochloric acid for each hydrogen ion concentration. Thus, incidentally, a comparison of the buffer capacity of the various forms was made. In the greater part of the work, separation of curd and whey was made by centrifugalizing the prepared samples of milk in 50 cc. centrifuge tubes at a uniform speed and for a definite length of time. Concentrations of calcium and protein in the whey were estimated, and the proportion and character of the curd thrown down were noted.

Buffer capacity was found to be practically the same for all the forms studied.

Comparison of the concentration of calcium in the whey with the character of the curd thrown down showed a definite relationship. The smallest and most compact curd and the lowest concentration of calcium in the whey were found in dried milk, by the roller process; the largest and most fluid curd and the highest concentration of calcium in the whey in the evaporated milks, while raw, pasteurized and boiled milk and dried milk, by the spray process, lay between these extremes and showed no significant differences among themselves.

In respect to concentration of protein in the whey, these forms of milk showed a different order of arrangement, apparently corresponding to the amount of heat to which they were subjected in the preparation. Thus, considering the values at the highest acidity, boiled milk contained in the whey less than half of the original soluble protein content, raw fresh milk the entire amount, pasteurized fresh milk and that dried by the spray process, almost as much as raw milk, while dried milk, roller process, and two brands of evaporated milk lay midway in order of arrangement.

The striking difference among these forms of milk was in the character of the curd thrown down by acid, as described in the foregoing. Generally speaking, the lower acidities showed the more cheesy curds.

The absolute differences among the milks in soluble calcium and protein were not great.

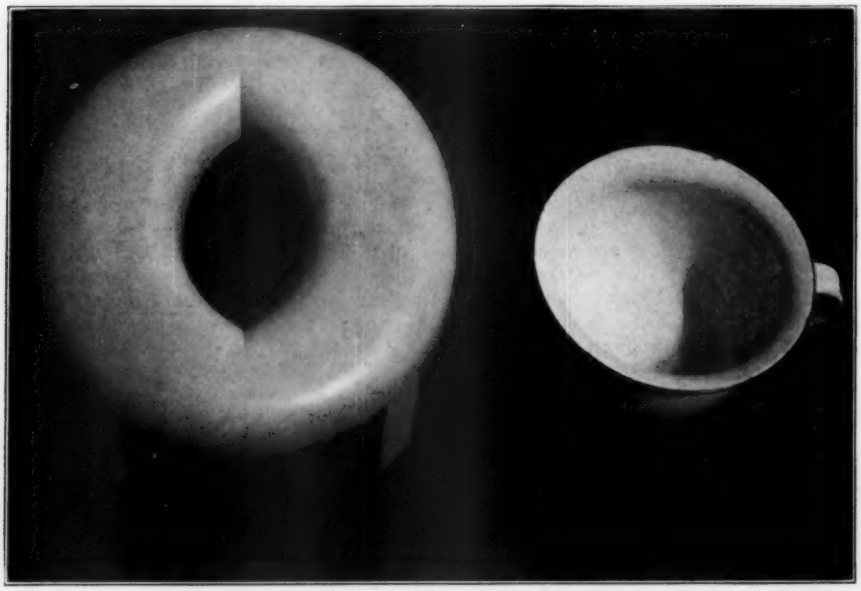
A Case of Thrombocytopenic Meningitis. Presented by Dr. G. F. Boyer.

This case occurred in a boy, aged 7, who suddenly collapsed with loss of power in his limbs and headache after three or four hours' malaise. On Sept. 9, 1923; Nov. 29, 1923; March 18, June 21 and July 15, 1924, he had severe sudden recurrences, some of which were accompanied by complete unconsciousness. His temperature was disturbed only on one occasion for a short time. He had intense diffuse retinal hemorrhages, and great quantities of intensely bloody cerebrospinal fluid were removed. All the cultures of blood and cerebrospinal fluid were sterile. He had exsanguination transfusions on the last two occasions. He never showed any sign of purpura. Later in the course, he showed splenic enlargement with decreased platelet counts, but he has remained well and free from recurrences of several clinical signs. His is an atypical case of thrombocytopenia that apparently has become quiescent.

New Device for Treatment of Prolapse of the Rectum. Presented by Dr. Alton Goldbloom.

The simple device illustrated by the accompanying photograph was devised by Goldbloom for the treatment of prolapse of the rectum. It is a small, ordinary toilet seat, with a narrow oval opening, producing pressure on the buttocks, and giving the same type of support as is given by strapping, except that the support is given only at the time when it is needed, namely, when the bowels are active.

The device, while not curative, is effective in preventing prolapse while it is used.



Goldbloom's device for treatment of prolapse of the rectum.

THE FATE OF FOREIGN BODIES SWALLOWED BY CHILDREN. Presented by DR. D. E. S. WISHART.

Eighty-four cases are reported.

At the Hospital for Sick Children in Toronto the foreign body is located by roentgen ray. If it has reached the stomach, the surgical service is responsible for the patient. All other patients are dealt with by the laryngological service.

Of the ten treated by the surgical service, one died. Of the seventy-four treated by the laryngological service, four died.

In eight cases the foreign body had been lodged more than seven days; in two of these for seven weeks. The foreign bodies consisted of: thirty-six coins, the largest a fifty cent piece; fourteen pins, the great majority being open safety pins; tin whistles, a metal dog, a jagged piece of lead, a large piece of glass, nails and a lump of linoleum, etc.

Several open safety pins were shoved into the respiratory tract by misguided attempts at removal by physicians. One reached a bronchus. The patients recovered.

One open "baby pin" was swallowed and was passed by rectum. Two open safety pins were recovered by gastrostomy. The time of passage of the foreign bodies from stomach to anus varied from two to seven days.

One child suffered from intestinal obstruction from swallowed sunflower seeds which became impacted in the rectum.

Useful rules are given to guide the physician who is confronted with a patient who is suspected of having swallowed or inhaled a foreign body.

Dr. Wishart closed his paper by quoting Dr. Chevalier Jackson's statement of the seven things that such a physician ought not to do.

CHICAGO PEDIATRIC SOCIETY

Clinical Meeting, Cook County Hospital, April 19, 1927

MAURICE L. BLATT, M.D., *Presiding*

EPIPHYSITIS (ACUTE). DR. KELLOGG SPEED.

A child, aged 2 years, entered the hospital on April 3 with a history of having contracted whooping cough one month before presentation. He had been sick for about two weeks, and about March 19 began to vomit several times a day; this persisted until his admission to the hospital. He was irritable, and eleven days before entrance to the hospital developed a hyperesthesia of the left leg. The leg was held flexed at the thigh and not adducted, and he complained whenever it was moved or touched. On admission to the hospital the temperature was 102 F., and he had the typical symptoms of the pneumonia of the lower lobe. The temperature rose to 103 F. on the day after admission but finally subsided, and the pneumonia cleared up; the symptoms of the leg, however, did not.

These cases are frequently overlooked by general practitioners, and are referred to surgeons with peculiar diagnoses. I have recently seen six cases of acute epiphysitis of the upper end of the femur. Two of them terminated in death, two in stiff hips, one in removal of the head of the femur and the other in drainage from which the child has not yet recovered.

In looking at the roentgenogram it can be seen that the head of the femur is not completely dislocated out of the acetabulum but is partly out, rotated and abducted. The difficulty is due to an early epiphysitis which filled the joint with fluid which may or may not become pus. One is misled by finding

fluctuations, and by not examining carefully for tenderness in the hip region. When these symptoms are found, drainage is indicated at once, and cutting down on the front of the hip is all that is required. This simple anterior drainage will be sufficient to save the epiphysis from further destruction and also will preserve the joint surface by releasing the pressure within the joint and by letting out the fluid which contains leukocytes, and which promotes a lytic action on the joint cartilage. This may be followed by further operation if necessary, depending on the opinion of the surgeon and on the pathologic changes found. A great mistake is often made by the surgeon in not opening the joint. He cuts down to the neck of the femur and finds a little exudate and scratches around the bone. He fails to find any pus, however, because he has not gone far enough. The hip joint should always be opened in every case of this kind, and it will be found that the exudate and infection have distended the joint and led to the difficulty.

INFECTION OF THE HIP. DR. KELLOGG SPEED.

A little girl entered the hospital on April 17, 1927, with a temperature of 103.8 F., complaining of pain in the right hip and inguinal region which had lasted for ten days. She was said to have hit her thigh against a desk at school. There was pain in the right hip, and she was unable to straighten the leg, and could not sleep. Vomiting, fever, and all the symptoms that might be expected in an acute attack of sepsis were present. The leg was adducted and painful to movement or pressure.

There is usually a history of trauma some time in the past in these cases, but it is not necessary for the diagnosis. No one knows where the infection comes from; it may come from the tonsils, the intestines or a cryptogenic source. The diagnosis of infested joint should be made and then, without hesitating, the joint should be drained, thereby saving the joint, the upper epiphysis of the femur and leaving a useful leg. There should not be any delay if the best results are to be obtained.

ERYTHEMATOUS LUPUS. DR. E. P. ZEISLER.

A boy, aged 8 years, was first seen two years previously with a lesion on the cheek which had been present since he was 5 years old. The condition was first diagnosed as lupus vulgaris, and he was treated for some time with the roentgen ray. This was not successful, and the lesion continued to enlarge. When first seen the patient had an inflammatory discoid patch the size of a silver dollar, with adherent scales, and presented a typical picture of erythematous lupus, which has nothing to do with true tuberculosis. The etiology is not known, but it is an exceedingly rare condition in childhood. I have seen but one other case in early life. One of the patient's uncles also had had erythematous lupus for twenty years, and another member of the family had tuberculosis, but roentgenologic examination of the patient did not show evidence of pulmonary involvement. At present there is only a remnant of the primary patch, but the border of the lesion is still active. The lesion was first treated by compression with the Kromayer lamp at intervals of two or three weeks, producing a marked reaction and healing of the lesion in the center. A few months ago, the boy was vaccinated by order of the school authorities, and an acute exacerbation occurred. New lesions appeared on the opposite cheek, and the condition spread with alarming rapidity. He was then given doses of ¼ grain (0.0116 Gm.) of iodoform internally, and wet dressings of calomine lotion were used locally, with satisfactory results.

Another treatment for erythematous lupus is in the intravenous use of gold and sodium thiosulphate in doses of 0.1 Gm., as recommended by Schamberg and some German workers, and is considered a specific in this disease. Excellent results have been reported, and this should be kept in mind as one of the best methods of treating patients who have this disorder.

ERYTHEMA NODOSUM. DR. S. L. BERMAN.

A boy, aged 3 years and 10 months, who had a normal birth and family history, entered the hospital on March 16 with a history of having been well, playing vigorously and not complaining until six days before presentation, when a large number of reddish spots had appeared on his legs. The legs were tender, and movement caused much pain. He had had a slight cough for two days, but physical examination showed practically no abnormalities. The tonsils were slightly enlarged and inflamed, some of the anterior and posterior cervical lymph glands were enlarged, and examination of the chest showed diminished resonance in the right intrascapular region. The legs from the knees to the ankles showed a large number of bluish-red, raised areas, not sharply circumscribed, tender to touch and painful on any movement which caused the skin to become more tense. The lesions varied in diameter from 1.5 to 2.5 cm. The Pirquet test was strongly positive. A roentgenogram on March 25 showed a triangular shadow of the hilum with an interlobar line. The eruption gradually faded and by March 25 had completely disappeared. On that day, a cantharides blister was applied, following the work of Kundratitz, who found that the blister serum of patients with erythema nodosum had a substance which activated tuberculin. The Mantoux reaction obtained with tuberculin diluted with this serum was usually stronger than one obtained with the same dilution of tuberculin and physiologic salt solution. Our results were negative. On March 29 we made a Mantoux test, injecting 1:10,000 tuberculin, and the reaction was marked. Around the indurated area there was a large erythematous zone from 4 to 5 cm. in diameter. On April 16 we injected 0.01 mg. of tuberculin subcutaneously. In five of eleven cases Ehrenberg found that lesions of erythema nodosum reappeared following injections of tuberculin, but such a response was not obtained in this case, although the child was extremely sensitive to tuberculin, and gave a marked as well as a general reaction at the site of injection. The skin shows a general hypersensitiveness to substances injected intracutaneously, salt solution, and glycerins (Moro). There was no history of tuberculosis in the family, and the other children in the family had a negative Pirquet reaction. It is said that in September, 1926, the family moved into an apartment in which some one had recently died of tuberculosis.

Our conclusion is that the child probably has tuberculosis, which is active and of recent origin, and that he is markedly hypersensitive to tuberculin. The erythema nodosum is the cutaneous expression of this hypersensitiveness to tuberculin in a child recently infected with tuberculosis.

PATHOLOGIC CHANGES IN THE KIDNEY. DR. S. L. BERMAN.

A boy, aged 4 years, was brought to the hospital because he had had fever at intervals for several months with intermittent swelling of the abdomen and lower extremities. The family and past history was negative. It appears that in September, 1926, the boy had a rash, but a physician was not called. Later in the week the legs became swollen, and a physician diagnosed the condition as nephritis following a possible scarlet fever. The child was hospitalized for two weeks and appeared to recover. After several weeks at home, the swelling reappeared, involving the face, abdomen and legs. He was again hospitalized for eight weeks and then brought to us at the Research and Educational Hospitals. The urine, as described by the mother, had been scanty and reddish, and appeared to contain pus at times. When the child was feverish, and on urination, he complained of pain in the back. Physical examination revealed marked edema of the face, abdominal wall, scrotum, hands and legs; the condition was more marked on the left side, the child having lain on this side. Free fluid was present in the abdominal cavity. The tonsils and pharynx appeared injected. Examination otherwise was negative. The temperature was 99.6 F. on entrance, the pulse rate 96 and respirations 26; urinalysis

showed a large amount of albumin, a moderate number of coarse granular casts and a moderate quantity of pus but no blood. Throughout the period of observation, the urine showed these characteristics, a specific gravity of from 1.010 to 1.022, and occasionally blood. The blood showed a secondary anemia with a normal differential count. The blood pressure ranged around 110 systolic, and 70 diastolic. The blood Wassermann reaction was negative. Roentgen ray of the paranasal sinuses showed no pathologic change.

The patient was placed on a salt-free, low protein diet. On January 25, the blood was taken before and after dinner for demonstration of protein. Before dinner it showed 35 mg. of nonprotein nitrogen, 21 mg. of urea and 1.43 mg. of creatinine. After dinner there was 39 mg. of nonprotein nitrogen, 21 mg. of urea and 1.36 mg. of creatinine. On January 31, the blood showed 417 mg. of cholesterol. On February 2, the serum albumin and globulin were determined and were found to be: 1.62 serum albumin and 2.78 serum globulin, about 75 per cent more globulin than albumin. The child was placed on magnesium sulphate, 4 Gm. daily, and later urea was added in the amount of 10 Gm. daily. His weight decreased from 18.6 to 16.1 Kg. The blood chemistry was repeated and showed a slight retention of chlorid in addition to a slight retention of nitrogenous elements.

On February 5, he was placed on a salt-free high protein diet; it was attempted to give him 40 Gm. of protein daily. On February 11, salt was added in the amount of 1 Gm. daily. On the 12th, the blood chemistry was repeated and showed no change; the cholesterol remained high, 550 mg. The serum albumin was further decreased, and the globulin was increased. On February 14, the cholesterol was about the same. The water content of the serum was determined and found to be 85 per cent. The child was slightly hydremic. On February 12, the urea and magnesium sulphate were discontinued. His weight was then 16.1 Kg.; it fluctuated until February 16 when it started to increase. He had a rise in temperature which persisted from the 15th to the 20th, and examintion revealed tonsillitis and pharyngitis. After the temperature returned to normal, the weight again diminished. On February 18, the magnesium sulphate and urea were again started. The urine remained unchanged, except that from the 23rd to the 25th it contained red blood cells. On March 3, a tonsillectomy was performed, but there was no change in the general condition of the child. On April 6, the blood chemistry showed observations of normal nitrogen. He is now getting from 36 to 39 grains (from 2.3 to 2.5 Gm.) of protein daily, and his weight is increasing. The intracutaneous test with physiologic salt solution showed a disappearance in twenty minutes on March 8th and in ten minutes on the 18th.

Our conclusion is that because of some toxemia the child had a general disturbance of water and salt metabolism in such a manner that the tissues combine readily with water, but this combination is unstable and the tissues give up the water as readily as they absorb it. We believe that there are pathologic changes in the tissues of the body generally, and that the storing of water is not due to disturbed function of the kidney only but to disturbed salt and water metabolism of the entire body. The kidneys probably show changes predominantly in the tubules. Blood has been found but rarely in the urine. There is only a slight retention of nitrogen in the blood, and the heart is not enlarged. We cannot, however, rule out glomerular involvement, for, pathologically, this is present frequently even in cases that appear clinically to be pure nephrosis.

MYOCARDITIS (FOLLOWING TYPHOID FEVER). DR. BLATT.

This boy is of interest because his case has been watched since 1925, when he was admitted to the Cook County Hospital with typhoid fever, being one of nineteen patients. In that series we had two deaths. In 1926, we also had two deaths, one from pneumonia complicating typhoid and one without complications. This boy had the typical typhoid history, beginning in September 1925,

and the heart symptoms began three days after his admission to the hospital. Repeated examination showed almost no valvular closing sound and no murmur. He had a galloping rhythm. The blood pressure was 98 systolic, and 10 diastolic. Just before this he had had intestinal hemorrhages; so at least part of the softness of the heart sounds were thought to be due to anemia. He was given whole blood, and the intestinal hemorrhages were controlled. On October 14, the heart sounds were still soft, and he had marked dyspnea. The condition was alarming, and he was placed on digitalis. On Nov. 5, 1925, the heart was entirely within normal limits. There was no murmur, and he was discharged on November 20, without any change in the rhythm or other signs of cardiac involvement.

On March 3, 1926, he was readmitted, with a generalized anasarca, ascites and all the evidences of decompensation. We could find nothing in the heart except a slight dilatation; the kidneys were normal and after a week's observation, we decided he had a competent heart and could go home. On April 29, he returned to the hospital with ascites, a marked cough, bloody urine and a heart that was virtually as large as it is at present. He was kept under observation until July 7, 1926, when he was sent home, apparently entirely compensated. The urine was normal, the anasarca had disappeared, and with the exception of the size of the heart, there was nothing that looked pathologic. At no time did he show any heart murmur.

His fourth entrance to the Cook County Hospital was on Feb. 16, 1927, when the blood pressure was 106 systolic, and 80 diastolic, he was markedly dyspneic, and there was dilatation of the superficial vessels of the trunk and abdomen. He seemed to be establishing a collateral venous circulation which was particularly marked on the right. The question was whether there was some adhesive pericarditis around the superior vena cava which was causing the development of the extensive collateral circulation with the inferior vena cava. He was put to bed and most of the venous dilatation has disappeared. He is fairly comfortable sitting or lying in bed. The heart has remained the same size and entirely without murmurs. The electrocardiograph has been entirely negative on several occasions. He has an eccentric hypertrophy, secondary to typhoid fever, and a typhoid myocarditis.

TUMOR OF THE BRAIN. DR. JOSEPH CALVIN.

A colored child, aged 5 years, had a history of normal birth. At the age of 2 years convulsions developed, following measles, for which the patient was given treatment for epilepsy at the Wesley Memorial Hospital. The attacks continued until he was 4 years of age, but he had had no attack since then. He developed a severe headache in the frontal region in November, 1926, and this has persisted. Paralysis of the right side, and vomiting without nausea began six weeks previous to presentation. His mother died of pulmonary tuberculosis within the past few months. He was admitted to the Cook County Hospital on March 18, 1927. His temperature has been practically normal since entrance. There is paralysis of the right side which is practically complete, including the face, arm and leg. The deep reflexes are increased on the right; there is a positive Oppenheim and ankle clonus. There is no sign of meningeal irritation. The child is unable to walk, but the mentality is clear. There are bilateral choked disks but no nystagmus or ocular paralysis. The spinal fluid is normal except for increased pressure. The Wassermann reaction is normal on the blood and spinal fluid. The Pirquet test is positive; the urinalysis is negative. A roentgenogram of the skull showed definite evidence of increased intracranial pressure; the anterior fontanel is still open; the suture lines are prominent; there are alternate areas of rarefaction and density throughout the skull (digitations).

Our conclusion is: 1. Although attacks of generalized convulsions may seem to be typically epileptic in character, some real pathologic change may be

present in the brain, although the localizing signs may not develop for some years. 2. This case is probably one of tumor of the brain localized in the left motor area which at first caused irritation and later paralysis. The only other possibility is a cyst which is large enough to cause the epileptic seizures early in the disease then becoming smaller but later filling up greater than before and producing the paresis. A diagnosis of brain involvement can be made from the skiagram alone, definitely indicating increased intracranial pressure. Because of the tuberculous family history and positive Pirquet, a tuberculoma must be strongly suspected.

NOTE.—Subsequent Course: Operation was refused by the family, and the patient gradually became comatose and died six weeks later. Autopsy revealed a large tuberculoma pressing on the left motor area.

CEREBROSPINAL SYPHILIS (?) ENCEPHALITIS (?) DR. JOSEPH CALVIN.

A girl, aged 5 years, had organic nervous disturbances which apparently were of an infectious nature. There was a history of headache during the month before presentation and inability to walk because of stiffness in the legs. There was also considerable difficulty in speech. The onset was relatively acute; there was no evidence of tuberculosis in the family. There was an occasional rise in temperature but no vomiting or cough. She had paralysis of the left external rectus, left facial paralysis and deviation of the tongue to the left. The pupils were equal and regular and reacted well. There were no signs of meningeal irritation, but the upper and lower extremities were spastic on the left, and the right leg was somewhat spastic. The reflexes of these extremities were increased. There was definite ankle clonus on both sides, and a positive Babinski sign on the left. The abdominal reflexes were absent. She had lost control of the bladder and rectum. The right arm functioned well. The blood Wassermann reaction was 2+, the spinal fluid reaction and cell count were normal. Examination of the retina showed pigmented lesions characteristic of syphilis.

The diagnosis was an inflammation of a more or less subacute nature of the brain and spinal cord. Whether it was due to a low grade form of encephalomyelitis without showing any changes in the fluid or to a cerebrospinal syphilis, is a question.

INFANT FEEDING. DR. M. L. BLATT.

CASE 1.—A boy entered the hospital when he was 3 weeks old, because of a pustular skin eruption. He weighed about 4½ pounds (2 Kg.), but with the exception of the eruption apparently was normal. He was given whole cow's milk until Dec. 8, 1926, when he was getting 583 calories for a weight of 5 pounds (2.3 Kg.). He was gaining little. He was given barley water and powdered protein milk and this diet was continued until April, 1927. He had measles during March. In May he was changed to cow's milk, and he was getting 24 ounces of milk for a weight of 11 pounds (5 Kg.) with a loss of weight due to a nasal infection. It was then decided to allow him to remain on cow's milk, and he gained steadily after the nasal infection had subsided. He showed one rather interesting complication in an inguinal hernia, which comes down, apparently strangulates partially, the temperature rises and vomiting begins. In a similar case seen in another hospital, the child was admitted with a diagnosis of acidosis.

CASE 2.—This child was brought from another hospital at 15 months of age, weighing 8¾ pounds (3.9 Kg.), and we thought it a case of "dystrophic infantilism." There was no apparent endocrine involvement. The history was that the mother died of tuberculosis two weeks after the child's birth. The Pirquet and Wassermann tests were negative, and roentgenograms of the chest and bones were negative for tuberculosis and syphilis. The child was put on

whole's cow's milk, receiving 1,084 calories. There had never been any intolerance to food of any kind, nor was there in the other child, even during the infection. The stools were normal and of the usual number. This child was in an almost cataleptic state for four months, never moving a hand or paying any attention to anything. After I returned from St. Louis last fall, she was placed on a diet of cultured lactic acid milk. S. M. A. was tried, but the weight went down to 7¾ pounds (3.5 Kg.) so she was placed on albumin milk with Dextri-Maltose. Salt solution was also given, and she improved immediately. She developed pneumonia but made a good recovery. Two weeks later, she developed chickenpox and later a bilateral otitis media. Then the weight dropped to 7 pounds 2 ounces (3.2½ Kg.), and she was put on a diet which consisted of seventeen tablespoonfuls of powdered protein milk, 1.5 ounces O. D. M., and 24 ounces of water. She gained uniformly for the next three months on this feeding, reaching a weight of 12 pounds (5.4 Kg.) at the end of that time. There has been no increase since February, when she was getting twenty tablespoonfuls of powdered protein milk to 30 ounces of water. She also receives cod liver oil and orange juice, cereals and purées and is in good condition.

DISCHARGING MASTOID SINUS. DR. A. LEVINSON.

A boy, aged 11, was admitted to the Cook County Hospital early this month with a history of enlargement of the abdomen and fever of two weeks' duration. He had coughed for four months and had been losing weight for two years. He had been at the hospital previously with practically the same symptoms. Eight months before admission, he had developed a left-sided otitis media, which later developed into an acute mastoiditis, for which a mastoidectomy was performed. Healing of the mastoid wound took place, but discharge from the middle ear continued. Two months later the boy complained of slight pain in the right ear, and two days after that there was a spontaneous rupture of the right mastoid with a profuse discharge, which has persisted. Tubercle bacilli were not found in the discharge, but Klebs-Loffler bacilli were present. Since then the boy had developed a left facial palsy. He was emaciated and has dulness in the left axillary region but no fluid. The roentgenogram showed an old pleuritis, a small cavity in the upper part of the right lung and infiltrative marking in the fields of the upper part of both lungs. The abdomen was rather full, with a suggestion of a fluid wave.

The diagnosis was a tuberculous process involving the entire body, manifesting itself in an old pleurisy, a tuberculous peritonitis and a right-sided mastoid sinus with a secondary Klebs-Loffler infection, a tuberculous otitis media and cervical glands.

TUBERCULOUS PERITONITIS. D. A. LEVINSON.

The patient showed typical symptoms of tuberculous peritonitis. After several days of study and observation, other possibilities were ruled out. The patient came in with a complaint of headache, and because he is a negro and because a great many colored children admitted to the hospital with headache are found to be suffering from meningitis, miliary tuberculosis was considered. The severe abdominal pain and constipation brought up the possibility of intestinal obstruction. On one occasion, typhoid fever was suggested. Therefore it was necessary to make a differential diagnosis between tuberculous peritonitis, tuberculous meningitis, generalized miliary tuberculosis and typhoid fever.

On the supposition that the child had an ascitic form of tuberculous peritonitis, the abdomen was tapped. The patient improved. The fluid intake was limited and also the bulk of solid food; thus the patient received a concentrated high caloric diet in as little volume as possible.

The question of the use of ultraviolet light was considered, and it was decided that the light should be used as long as the temperature was below 101 F.

GONORRHEAL ARTHRITIS. DR. PHILIP ROSENBLUM.

A negro child, aged 4 years, was admitted to the hospital in February with a vaginal discharge. Two weeks after admission, she developed an acute swelling of the left knee joint and a temperature varying from 99 to 102.5 F. per rectum. The vaginal discharge was found to be gonorrheal, and in view of the fact that the condition in the knee joint did not respond to treatment with salicylates, it was felt that it was a gonorrheal arthritis. The knee is still swollen, but there is no involvement of the joint itself. In adults the history of the duration of the infection is more clean-cut. Dr. Murphy used to teach that an arthritis that developed three weeks after the primary infection was usually gonorrheal. It might start as a periarticular infection, but if it ended in one joint, the infection was usually of gonorrheal origin. There was no definite information as to how long this child had had the infection, but it had been noticed that the discharge had become more profuse a week before admission. Fluid had not been removed for a complement-fixation test. She improved steadily under general care and treatment with gonorrheal vaccine.

DIABETES MELLITUS. DR. LOUIS J. HALPERN.

CASE 1.—A boy, aged 10, was brought to the hospital in January in coma; the urine was full of sugar and acetone. By means of large doses of insulin he was brought out of the coma in a period of five or six hours, and following this he was put on a maintenance diet. When the urine became sugar-free, the blood sugar remained a little elevated. The diet was increased and no insulin given, and in the course of about a weak his urine was free and the blood was normal. The diet was something like 3.5 Gm. of fat, 2 Gm. of protein and 2 of carbohydrate per kilogram of body weight. The possibility of his not having true diabetes was then considered, and a sugar tolerance test was made, which showed a curve within normal limits. At the end of four hours, the blood sugar was slightly below normal. He was put on a regular ward diet, and in two days threw off 55 Gm. of sugar. He was then put back on the previous diabetic diet, this time covered with insulin, which he did not receive on the nondiabetic diet. He again began to improve and became sugar-free, but the blood sugar remained elevated. The diet and insulin were increased, and his urine soon became sugar-free and the blood sugar was reduced to 130 mg. At present he is on a diet on which he is gaining weight; the urine is sugar-free, the blood sugar is 110, and he is not receiving insulin.

CASE 2.—A boy was brought back to the hospital in diabetic coma for the fourth time a month previous to presentation. When he was discharged the last time, he was receiving 35 units of insulin, which he was taking himself. Because of neglect either in his diet or in the taking of the insulin, or both, he again went back into coma. The time before this he showed a typical picture of lipemia retinalis, but this was absent on the present admission. By means of large doses of insulin not covered with orange juice or sugar, he was brought out of coma in eight hours. He was then placed on a maintenance diet, and because he continued to run sugar in the urine as well as a high blood sugar, he was given 15 units of insulin daily. He continued to have sugar in his urine, his blood sugar remained elevated, and he was losing weight. His diet was therefore gradually increased and so was the insulin, until at present his diet gives him 60 calories per kilogram of body weight, and he is taking 40 units of insulin daily. The greater portion of the insulin was given in the morning because four hour specimens of urine showed that most of the sugar was being thrown off then. He is gaining weight consistently, his urine is sugar-free, and his blood sugar is within normal limits.

PSEUDOHYPERTROPHIC MUSCULAR PARALYSIS IN BROTHERS, (LANDOUZY-DEJERINE TYPE). DR. C. K. STULIK, JR.

Two brothers, aged 11 and 9, respectively, had been in the hospital for a month. John, the elder, was brought in because of an infection of the upper

respiratory tract which was diagnosed as influenza. Examination revealed a hypertrophic paralysis. In both instances the trouble started in 1923, when the boys were given a prophylactic dose of antitoxin. The four children in the family received this treatment, and these two boys developed muscular paralysis with progressive weakness. They had been so weak that they had had to go to the school for crippled children. They had the classic symptoms of muscular paralysis. John had a palpable thyroid and testes that were just within the internal ring. There was also a varus position of one foot which could be corrected on pressure. John had a negative blood Wassermann reaction and a 1+ spinal fluid reaction, with a blood sugar of 70. Stanley had a blood sugar of 58 and a spinal fluid sugar of 90. Both of the boys were high grade mental defectives, John having an intelligence quotient of 49 and Stanley one of 56. Roentgenographic examination was negative, and there was no visualization of the pineal body. The treatment advised by the members of the orthopedic staff was epinephrine 3/120 grains (0.001 Gm.) three times a day under the tongue, 15 grains (0.97 Gm.) of potassium iodide, ultraviolet therapy and massage, and these measures have brought about some improvement.

Biopsy of muscle taken from the gastrocnemius of both boys revealed the typical picture of a mixture of enlarged fibers, fat cells, connective tissue and atrophic muscle fibers.

RESUMÉ OF TYPHOID FEVER FOR SIX MONTHS. DR. E. W. TELFORD.

From October, 1926, to March, 1927, inclusive there were ten patients with cases of proved typhoid admitted to the children's ward of Cook County Hospital, and there is a patient in the ward now that was admitted during March, making eleven cases for six months, which is close to the former figure of twenty-two cases for the year. Of the ten cases, seven occurred in white children, and three in colored. It is interesting that the white children came from the near southwest and west sides of the city, all of them living within a three or four mile radius.

Of seven available records, four show that the patients were sick only a week before entering the hospital, two were sick two weeks, and only one was sick for three weeks before being brought to the hospital. In every case the parents said that they had noticed enough fever to make them consider it necessary to bring the child to the hospital. Three patients complained of diarrhea, and two of abdominal pain. One complained of headache and only one of signs referable to the meninges. Only one had delirium.

Regarding the physical observations other than the temperature, three of the patients showed rose spots on admission, two showed marked stupor, one had a palpable spleen and one a definite meningismus, with Kernig and Babinski signs, which disappeared in a day or two. Only one patient showed abdominal tenderness and only one a relatively slow pulse compared with the high temperature. That child had a temperature of from 102 to 103 F. on admission with a pulse rate below 100. The Widal test was positive in six cases on admission, and in one case it became positive a week later. In six cases the stools were normal on admission and in one case did not become normal for a week or more after admission. In two cases the blood cultures were positive on admission; in the rest they were negative. The white blood counts were 5,400, 5,200, 6,600, 13,400, 8,600 and 5,400, averaging 8,800. This is to be noted, considering the fact that all patients had a temperature of 101 F. or over. There was a tendency in every case for the mononuclear cells to exceed the polymorphonuclear. The urine in each case was normal when examined microscopically, and albumin was not present. Complications developed only once in the group, in a case which was fatal. After being in the hospital for two weeks, that child developed otitis media. The ear was opened and drained, but the termination was fatal. Postmortem examination showed the usual intestinal observations of typhoid fever.

DISCUSSION

DR. BLATT: One case was not mentioned in this series. These are all cases from the health department, and when typhoid occurs in an adult in a family, immunization occurs. If, at the end of two or three weeks, that person is admitted to the hospital and the titer has been raised, it is a question whether it is a typhoid or an immunization to the typhoid vaccine. In one case the patient did not have any vaccine because a mother with a nursing infant was brought in. There was no question about the mother having the typhoid and about the baby having been immunized. The infant was brought into the hospital and remained with its mother in the ward. The child had a fever and a high titer to typhoid. The white blood cell count was low, and the course lasted only from ten to twelve days and then cleared up. The stool was normal as long as the patient was in the hospital.

Book Reviews

ADAPTED GROUP GYMNASTICS. By LILIAN CURTIS DREW. Price, $2. Pp. 148. Philadelphia: Lea & Febiger, 1927.

With the growing interest in, and increased knowledge of, functional methods of diagnosis and treatment in the diseases of children, physical exercise both as a preventive and a curative means must necessarily come into the front ranks. In heart disease, hyperkinesis, motor restlessness, lack of control and in muscular tics, no therapeutic measure excels that form of physical education which emphasizes specific corrective exercises and gymnastics. The pediatrician anxiously awaits a classification of exercises based on physiologic principles and applicable to functional disorders. Moreover, the routine lock step system of physical education at present in vogue in the schools makes a change imperative in which the child will be considered, in which the necessary distinction is made between the tall and the short, the fat and the lean, the overweight and the underweight. This new type of physical training must include exercises based on the functional capacity of the child rather than on his chronologic age or school grade.

This monograph might well have filled these needs. In the first part a large number of exercises are enumerated with clear-cut directions for their use. In the second part the treatment of disorders, such as lordosis, scoliosis, visceroptosis, weak and fallen arches, constipation and other rather common disorders of childhood is discussed. Unfortunately, the clinical section falls short of expectations. The brevity and preciseness which distinguish part I, throws part II into confusion. On page 142, referring to the exercises for the heart, the author states, "The results in most cases are gratifying. The exercise tolerance increases rapidly and progression to more difficult exercises can be made steadily." On page 143 in the chapter on enlarged thyroids, the author continues to write, "as a weak heart is a frequent accompaniment of this condition (enlarged thyroid) the indications for exercise are practically the same." Again, all types of nervousness are lumped together and treated by "the faithful five for fitness." Whether the child suffers from "complexes," "depression," moods, overexcitability, irritability or malmental states (page 146), he must subscribe to the same kind of exercise. This sort of writing seems to the reviewer an unfinished job at classification of diseases for the purpose of treatment. Despite these shortcomings, the book can be recommended for office use for pediatricians.

TUBERKULOSE DER KINDER. By H. KLEINSCHMIDT. Second revised edition. Price, 11.40 marks, unbound; 13 marks, bound. Pp. 221, with 6 illustrations, and 12 plates. Leipzig: Johann Ambrosius Barth, 1927.

This book is appearing in the second edition, but for the first time as a separate monograph. The first edition, occurring as part of the "Handbuch der Tuberkulose," left many discrepancies which have been largely eliminated through enlargement and revision, and in consequence, this book will undoubtedly take its place as one of the best works available on tuberculosis of childhood.

It contains a most excellent discussion on immunity and the modes of infection, and compares the conclusions arrived at from clinical and anatomic studies on tuberculous children with those observed in experimental animals. The clinical diagnosis takes up first the constitutional symptoms, and then the special phases under the familiar heading: primary, secondary and tertiary forms of tuberculosis. The section on treatment has been brought up to date through the inclusion of chapters on artificial pneumothorax, heliotherapy and nonspecific protein therapy.

Despite the general excellence of the monograph, two things seriously detract from the value of the book, and both are extremely common in much of the German literature. The first of these concerns the habit of referring in parenthesis to an author without citing the specific work to which reference is made. This omission is only partially atoned for by a rather long bibliography at the end of the volume. The other, and more glaring fault, is the almost complete absence of references to any work not published in the German language. Surely no work on tuberculosis can be considered complete which entirely ignores all publications of English, French and American workers, many of them antedating similar investigations of the Germans.

The volume is written in simple language, and the arrangement is logical. It merits translation into English.

DEMENTIA RACHITICA: STUDIEN UEBER DIE SOGENANNTE ZEREBRALE KOMPONENTE DER RACHITIS. By DR. KURT HULDSCHINSKY. Price, 2.70 marks. Pp. 60. Berlin: S. Karger, 1926.

Kurt Huldschinsky found that children suffering from rickets show psychic manifestations such as catatonia during the florid stage of the disease, mental deficiency during the stage of repair and paranoid tendencies still later. The author is convinced that psychic symptoms constitute a real psychosis, which manifests itself in a schizophrenic form with its various stages. When the schizophrenic stage disappears, the stage of dementia develops.

The author differentiates between metarachitic mental debility which accompanies severe forms of rickets and real idiocy which may be associated with rickets. The author also believes that parallel with the rachitophrenia there are pathologic processes in the brain which manifest themselves mainly in the enlargement of the brain. The author determined the enlargement by his study of the index of the skull.

Directory of Pediatric Societies

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION OF DISEASES OF CHILDREN

Chairman: Dr. Hugh McCulloch, 500 S. Kingshighway, St. Louis.
Secretary: Dr. C. A. Aldrich, 545 Lincoln Ave., Winnetka, Ill.
Place: Minneapolis. Time: To be decided later.

AMERICAN PEDIATRIC SOCIETY

President: Dr. J. Claxton Gittings, 1828 Pine St., Philadelphia.
Secretary: Dr. Howard Childs Carpenter, 1805 Spruce St., Philadelphia.
Place: Washington, D. C. Time: April 30 to May 2, 1928.

THE ASSOCIATION OF AMERICAN TEACHERS OF THE DISEASES OF CHILDREN

President: Dr. J. P. Crozier Griffith, 1810 Spruce St., Philadelphia.
Secretary: Dr. Paul W. Emerson, 86 Bay State Road, Boston.
Place: Minneapolis. Time: Spring.

AMERICAN CHILD HEALTH ASSOCIATION

President: Hon. Herbert Hoover, 370 Seventh Ave., New York.
Secretary: Dr. Philip Van Ingen, 370 Seventh Ave., New York.
Place: Undecided. Time: May or June, 1928.

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President: Dr. G. R. Pirie, 20 Madison Ave., Toronto.
Secretary: Dr. A. P. Hart, 1844 Bloor St. West, Toronto.
Place: Vancouver, B. C. Time: June, 1928.

SECTIONAL

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President: Dr. O. L. Goehle, 15703 Detroit Ave., Lakewood, Ohio.
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Place: Cleveland. Time: Oct. 14 and 15, 1927.

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Secretary: Dr. Hugh L. Dwyer, Medical Arts Bldg., Kansas City, Mo.
Place: Memphis, Tenn. Time: Nov. 14 to 17, 1927.

LOCAL

NORTHERN CALIFORNIA PEDIATRIC SOCIETY

President: Dr. C. F. Gelston, 384 Post St., San Francisco.

Secretary: Dr. Mary H. Layman, 2116 Pacific Ave., San Francisco.

Place: Alternates between Stanford University Hospital, University of California Hospital, and Children's Hospital. Time: Three or four times a season.

SOUTHWESTERN PEDIATRIC SOCIETY

President: Dr. Oscar Reiss, Westlake Professional Bldg., Los Angeles.

Secretary: Dr. William Sidney Bowers, 1136 West 6th St., Los Angeles.

Place: University Club of Los Angeles. Time: First Wednesday in January, March, May, September and November.

THE ROCKY MOUNTAIN PEDIATRIC SOCIETY

President: Dr. W. Wiley Jones, Majestic Bldg., Denver.

Secretary: Dr. Berryman Green, 537 Republic Bldg., Denver.

Place: Children's Hospital, Denver. Time: Third Saturday of each month, 2:30 p. m., September to May, inclusive.

PEDIATRIC SECTION OF FULTON COUNTY MEDICAL SOCIETY, ATLANTA, GA.

President: Dr. William W. Anderson, 362 Peachtree St., Atlanta.

Secretary: Dr. Lee Bivings, Exchange Bldg., Atlanta.

Place: Academy of Medicine, 32 Howard St., Atlanta.

Time: Second Thursday of each month from October to April, at 8 p. m.

NEW ENGLAND PEDIATRIC SOCIETY

President: Dr. James Herbert Young, 66 Commonwealth Ave., Boston.

Secretary: Dr. Thomas Lanman, 286 Marlborough St., Boston.

Place: Boston Medical Library. Time: Second Friday of each month.

CHICAGO PEDIATRIC SOCIETY

President: Dr. Maurice Blatt, 30 N. Michigan Ave., Chicago.

Secretary: Dr. J. K. Calvin, 104 S. Michigan Ave., Chicago.

Place: City Club. Time: Third Tuesday of each month.

LOUISIANA STATE PEDIATRIC SOCIETY

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Secretary: Dr. F. J. Kinberger, 3601 Prytania St., New Orleans.

DETROIT PEDIATRIC SOCIETY

President: Dr. Thomas B. Cooley, 987 Jefferson Ave., East, Detroit.

Secretary: Dr. W. S. O'Donnell, 1563 David Whitney Bldg., Detroit.

Place: Children's Hospital of Michigan. Time: No fixed date; approximately once a month.

NORTHWESTERN PEDIATRIC SOCIETY

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Secretary: Dr. E. S. Platou, 730 La Salle Bldg., Minneapolis.

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Secretary: Dr. E. H. Rohlfing, 816 Beaumont Medical Bldg., St. Louis.

Place: St. Louis Children's Hospital. Time: At least once a year and contingent thereafter on the arrangement of a suitable program.

BROOKLYN PEDIATRIC SOCIETY

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Secretary: Dr. Charles A. Weymuller, 61 Greene Ave., Brooklyn.

Place: Kings County Medical Society Bldg. Time: Last Wednesday of each month, except June, July and August.

BRONX PEDIATRIC SOCIETY

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Secretary: L. H. Barenberg, 1749 Grand Concourse, New York.

Place: Concourse Plaza, 161st St., and Grand Concourse, New York. Time: Second Wednesday of each month, except June, July, August and September.

CENTRAL NEW YORK PEDIATRIC CLUB

President: Dr. Frank Vander Bogert, 111 Union St., Schenectady, N. Y.

Secretary: Dr. Frank J. Williams, 58 S. Swan St., Albany, N. Y.

Place: Various Cities in New York. Time: Fourth Thursday of October, January and April.

PEDIATRIC SECTION OF THE NEW YORK ACADEMY OF MEDICINE

President: Dr. William Ropes May, 8 East 66th St., New York.

Secretary: Dr. Stafford McLean, 17 East 71st St., New York.

Place: New York Academy of Medicine, 2 East 103d St. Time: Second Thursday of each month from October to May, inclusive, 8:30 p. m.

THE PEDIATRIC SECTION OF THE ACADEMY OF MEDICINE OF CLEVELAND

Chairman: Dr. Henry J. Gerstenberger, 2103 Adelbert Road, Cleveland.
Secretary: Dr. Charles W. Burhans, 2103 Adelbert Road, Cleveland.
Place: 2009 Adelbert Road. Time: Four meetings, from September to May.

PHILADELPHIA PEDIATRIC SOCIETY

President: Dr. Edward L. Bauer, Jefferson Medical College, Philadelphia.
Secretary: Dr. John Porter Scott, 2040 Pine St., Philadelphia.
Place: College of Physicians, 19 S. 22nd St., Philadelphia. Time: Second Tuesday of each month from October to June, inclusive.

MEMPHIS PEDIATRIC SOCIETY

President: Dr. F. T. Mitchell, 376 S. Bellevue Ave., Memphis, Tenn.
Secretary: Dr. Arthur G. Quinlan, 1193 Madison Ave., Memphis, Tenn.
Place: Memphis General Hospital. Time: Second Tuesday of each month.

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President: Dr. Lucius D. Hill, Medical Arts Bldg., San Antonio.
Secretary and Treasurer: Dr. Edwin G. Schwarz, Medical Arts Bldg., Fort Worth.
Place: Houston. Time: December, 1927.

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President: Dr. M. A. Cox, 34 St. Clair Ave. West, Toronto.
Secretary: Dr. F. R. Hassard, 1361 King St. West, Toronto.
Time: November 17, December 15, February 16 and March 15.

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President: Dr. Roy M. Greenthal, 141 East Wisconsin Ave., Milwaukee.
Secretary: Dr. M. G. Peterman, 167 Seventeenth St., Milwaukee.
Place: Children's Hospital, Milwaukee. Time: Second Wednesday of each alternate month, beginning with February.

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